REPORTABLE INFECTIOUS DISEASES IN KANSAS

2016 SUMMARY

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INTRODUCTION

PURPOSE AND FORMAT OF REPORT

This is the 21st annual summary of reportable diseases published by the Kansas Department of Health and Environment (KDHE). The purpose of this report is to provide useful information for health care providers, public health colleagues, and policy makers about infectious diseases in Kansas. The focus of the report is the assessment of disease trends, including incidence, severity, populations affected, and risk factors for infection.

The following reportable diseases are not included in this summary: chancroid, chlamydia, gonorrhea, Human Immunodeficiency Virus (HIV), tuberculosis, and syphilis. Statistical information for these diseases can be found at the KDHE's Bureau of Disease Control and Prevention website at http://www.kdheks.gov/bdcp/index.html.

There were some reportable diseases that were not detected during 2016; so, no information is presented for those diseases. Cases must meet the surveillance definition for a confirmed or probable case and have been reported to KDHE before May 1, 2017 to be included in this document.

Incidence rates have been calculated from the 2016 population estimates provided by the U.S. Census Bureau. Whenever possible, information about disease trends for the United States has been included for comparison with Kansas' trends. Due to confidentiality concerns, limited demographic information is presented if fewer than five total cases of a disease were reported.

Race is collected for most diseases using the following categories: American Indian/Alaska Native, Asian/Pacific Islander, Black/African-American, and White. If an individual reports more than one race category, the race is classified as "Other." Currently, incidence calculations are not performed for the "Other" race category. Ethnicity data is reported as either Hispanic or non-Hispanic. Disease incidence of urban and non-urban counties has been included. Urban counties are defined as having a population density of greater than 150 people per square mile. Kansas' six urban counties account for more than half of the state's population: Johnson, Wyandotte, Sedgwick, Shawnee, Douglas, and Leavenworth. The remaining 99 counties in the state are aggregated into the "non-urban" category.

The report is divided into three sections. Section I presents summaries of infectious, reportable diseases or conditions of public health importance. Each of the disease summaries includes a brief overview of the disease and selected analysis of the disease in Kansas. Section II includes special studies and reports. Section III includes reference documents and supplementary tables.

DISEASE REPORTING IN KANSAS

Health care providers, laboratories, and hospitals are required by Kansas law (K.S.A. 65-118, 65-128; 65-6001 through 65-6007; K.A.R. 28-1-2, 28-1-4, and 28-1-18) to report selected diseases and conditions. Reports of infectious diseases are initially sent to KDHE's Bureau of Epidemiology and Public Health Informatics, where they are reviewed and forwarded to local health departments. The local health departments are responsible for any required investigation and for instituting basic public health interventions.

Case reports are stored in Kansas' electronic disease surveillance system (also known as EpiTrax). EpiTrax is a central, statewide database of reportable and selected non-reportable diseases and conditions. It can be accessed via the internet by authorized public health officials. To protect restricted, confidential, health and clinical data of individuals, internal security structures are in place. EpiTrax allows users to report disease occurrences rapidly and efficiently; users may also generate summary statistics and reports to assist in evaluating public health efforts. Kansas' disease cases are transmitted from EpiTrax to the Centers for Disease Control and Prevention (CDC) every week for inclusion in *Morbidity and Mortality Weekly Report* (*MMWR*), a series of publications produced by the CDC.

In collaboration with the Council of State and Territorial Epidemiologists (CSTE), CDC publishes case definitions for public health surveillance - the CDC/CSTE surveillance case definitions combine clinical, laboratory, and epidemiologic criteria. By providing uniform criteria for disease reporting, case definitions allow greater specificity and comparability of diseases reported from different geographic regions. The CDC/CSTE case definitions can be found at http://wwwn.cdc.gov/nndss/conditions/notifiable/2016/infectious-diseases/.

The usefulness of public health surveillance data depends on its uniformity, simplicity, and timeliness. The case definitions in this report follow the CDC/CSTE surveillance definitions for disease reporting and should not be confused with clinical diagnoses. The use of additional clinical, epidemiologic, and laboratory data may enable a physician to diagnose a disease even though the formal standardized surveillance case definition may not be met.

INTERPRETATION OF THE DATA

When interpreting the data in this report, it is important to remember that the completeness of disease reporting is variable. For example, nationwide reporting of salmonellosis is estimated to be 2% complete; the actual number of persons infected with the disease is likely much higher than the number who sought medical care and were in turn reported to public health. When interpreting data, absolute numbers are less meaningful than trends; however, trends can be influenced by changes in case definitions, reporting patterns, and by random fluctuations. It is also important to note that small numbers affect rates and interpretation of rates. Small case numbers can produce artificially high disease rates and unstable, widely fluctuating disease trends.

In addition, prior to 2012, only cases classified as "confirmed" were included in disease counts and rates for *Reportable Infectious Diseases in Kansas*. Beginning in 2012, in accordance with how case counts are transmitted to CDC for publication in the MMWR, both confirmed and probable case counts are included for many diseases presented in the summary. Because of this change, counts and rates may be higher in published summaries after 2011. The case report counts that now include confirmed and probable cases are acute flaccid myelitis; anthrax; arboviral disease; brucellosis; campylobacteriosis; cryptosporidiosis; cyclosporiasis; dengue hemorrhagic fever; diphtheria; ehrlichiosis/anaplasmosis; giardiasis; *Haemophilus influenzae*, invasive disease (including Hib); hemolytic-uremic syndrome, post-diarrheal (HUS); Lyme disease; meningococcal disease; mumps; pertussis; plague; psittacosis; Q fever, acute and chronic; salmonellosis; severe acute respiratory syndrome (SARS); Shiga toxin-producing *Escherichia coli* (STEC); shigellosis; spotted fever rickettsiosis; tetanus; toxic-shock syndrome (staphylococcal and streptococcal); tularemia; typhoid fever; varicella; yellow fever; and zika virus infection and disease.

2016 NOTABLE DISEASE EVENTS

***Salmonella* Newport**: A salmonellosis outbreak was identified among case-patients that reported attending the Kansas State Fair. Investigation revealed that one food vendor, operated by a non-profit organization, was a common exposure among the ill persons. A case-control study was conducted to determine associations between illness and food exposures at the specific food vendor. Ten cases of salmonellosis were identified, and analysis showed that bean burritos, pork burritos, and queso crunch wraps were statistically associated with illness. *Salmonella* Newport was isolated from all eight stool specimens that were submitted for testing and seven of those were indistinguishable by pulsed-field gel electrophoresis (PFGE). The Kansas Department of Agriculture conducted an inspection of the vendor prior to the fair; four violations were observed and corrected. A traceback investigation conducted among the common ingredients found in the food items associated with illness (tomatoes, tortillas, and lettuce) did not identify a source of contamination.

Norovirus and *Clostridium perfringens*: An outbreak of both norovirus and *Clostridium perfringens* was identified after a citizen complained of gastrointestinal illness among a large party that attended the New Theatre Restaurant in Johnson County. An in-depth, food specific, questionnaire was developed and utilized to identify cause and scope of illness. Due to additional reports of illness from numerous persons that attended the theater on other dates, a press release was issued with a web link to an online questionnaire. Investigation revealed that 621 persons and 55 persons became ill with norovirus and *C. perfringens*, respectively. Using the right buffet line; consuming salad, specifically with jicama and ranch dressing; and consuming bread were significantly associated with norovirus illness. Consuming poppy seed dressing and burnt ends were significantly associated with *C. perfringens* illness. Seven ill persons submitted stools specimens for laboratory testing; five tested positive for norovirus and one tested positive for *C. perfringens* enterotoxin type A and *C. perfringens* was isolated from that specimen. Attendees and employees reported gastrointestinal illness prior to and during the performance, which may have led to environmental contamination. Multiple rounds of inspections, including a Hazard Analysis Critical Control Point inspection, were completed by the Kansas Department of Agriculture to observe and correct food preparation, food handling, and cleaning procedures. In addition, the dinner theater hired a professional cleaning company to disinfect the entire facility.

Shiga Toxin-Producing E. coli (STEC): An outbreak of STEC O157:H7 was identified when five individuals with indistinguishable PFGE patterns reported attending the Louisburg Cider Mill Festival. A press release and an online, outbreak-specific questionnaire were distributed, and a matched case-control study was conducted to determine associations between illness and festival exposures. Fifty-six case-patients were identified. Drinking any type of cold cider or eating doughnuts were significantly associated with illness. An environmental assessment was conducted that included collecting and testing environmental samples, apples, and prepackaged cider, as well as observing the food service processes. No contamination or violations were noted; however, staff reported that when demand was high, cider mill employees would obtain large quantities of cider from a chilled storage tank rather than using gallon jugs of pasteurized cider for food and drink preparation. This storage tank contained unpasteurized cider unbeknownst to employees. The storage tank has now been clearly labeled as containing unpasteurized cider.

***Salmonella* Muenchen:** A multistate outbreak of salmonellosis associated with the consumption of alfalfa sprouts was identified by indistinguishable PFGE patterns found in multiple states' isolates. Twenty-six case-patients from 12 states were identified as part of this outbreak, with five case-

patients being identified among Kansas residents. The ages of the Kansas case-patients ranged from 30 to 73 years, and illness onsets ranged from 12/9/2015 to 1/21/2016. All case-patients reported eating alfalfa sprouts seven days before their illness onset, all of which were eaten at different Kansas restaurants that used sprouts from the same Kansas sprouter. Traceback investigation lead to the conclusion that the alfalfa seed lot was contaminated, and the seeds and affected sprouts were recalled. For more information, see the CDC outbreak page.

Impetigo: An outbreak of impetigo was identified among individuals associated with a Shawnee County football team. Thirty-nine cases were identified that were either on the football team or had contact with a player. *Staphylococcus aureus* was isolated from two specimens, a known cause of impetigo infection. Symptoms included fluid filled sores that ruptured easily and rash with onset dates peaking following the first day of football practice. A common exposure reported by case-patients was use of field equipment during the first week of practice. A questionnaire completed by all ill persons was unable to determine if transmission was environmental, person-to-person, or a combination.

Methicillin-Resistant *Staphyloccocus aureus*: An outbreak of MRSA was identified in the neonatal intensive care unit (NICU) at a large acute care hospital in Kansas. Laboratory testing identified two infected infants and three colonized infants with an indistinguishable PFGE pattern similar to a strain associated with community-acquired MRSA. All five case-infants had been exposed to endotracheal tubes and central venous catheters. Staffing patterns were assessed prior to the outbreak onset to determine if there were any commonalities between staff members who cared for all the case-infants; no staff commonalities were identified. Infection control measures were immediately put into place to limit the spread of infection, including: cohorting of infected, colonized, and non-colonized infants or new admissions; policy review and staff training; and enhanced MRSA screening.

2016 INFECTIOUS DISEASE OUTBREAKS

[*NOTE*: Written reports of outbreak investigations can be found at http://www.kdheks.gov/epi/outbreaks.htm]

In 2016, the Kansas Department of Health and Environment's (KDHE) Infectious Disease Epidemiology and Response team investigated 123 suspected outbreaks of infectious disease. Eighty-eight confirmed outbreaks were identified; 2,335 ill persons were associated with these outbreaks. The median annual number of confirmed outbreaks from 2013-2015 was 64 (range, 52 to 101).

The 88 outbreaks were categorized as follows: 73 enteric outbreaks, 8 vaccine-preventable disease (VPD) outbreaks, 2 legionellosis outbreaks, 4 other outbreaks (non-reportable diseases), and 1 outbreak with unknown etiology, Table 1. Seventy-three (82.9%) of the 88 confirmed outbreaks caused gastrointestinal illness.

Norovirus was the most common causative agent for outbreaks in 2016 (27 outbreaks), resulting in 1,429 total reported cases. Norovirus is not a reportable disease in Kansas, but outbreaks are reportable. If interested in more information on norovirus, please visit CDC's Norovirus Page. Among all other enteric outbreaks in 2016, one outbreak caused by Shiga toxin-producing *E. coli* resulted in the next highest number of reported cases (56 total cases). Among VPD outbreaks, influenza was the most common causative agent with four outbreaks and 147 total cases.

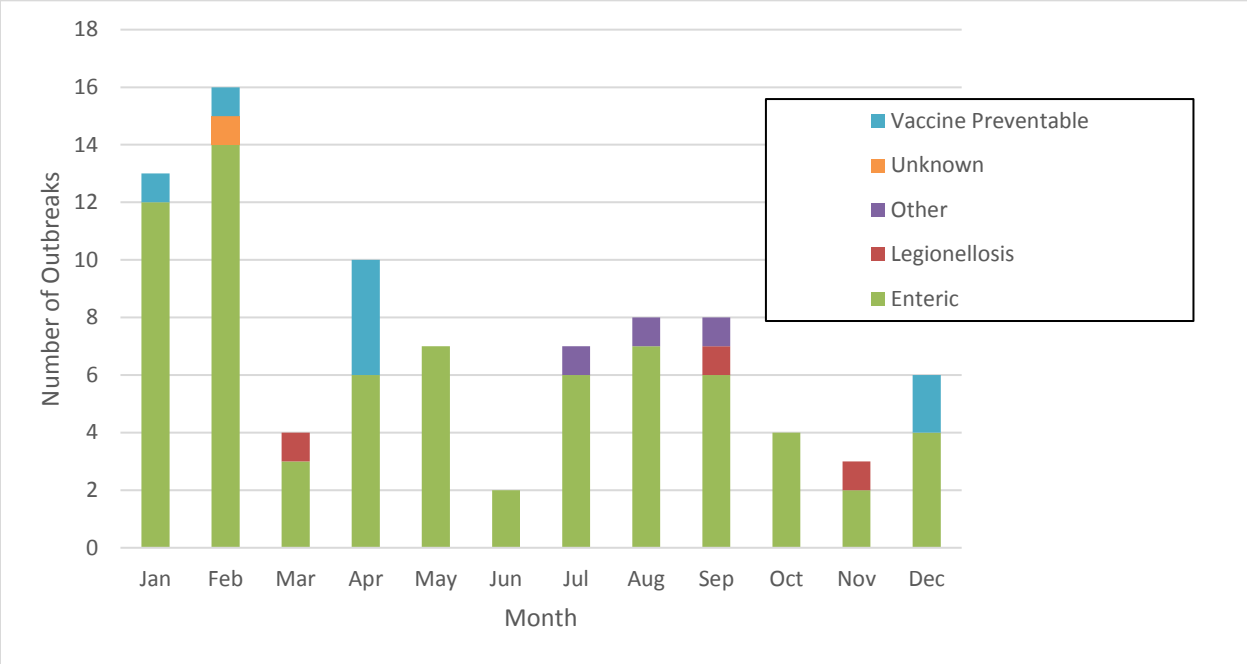
Table 1: Number of Outbreak Cases by Disease Type, Kansas, 2016

Disease Type	*# of Confirmed Outbreaks*	*# of Outbreak Cases*	*% of Outbreak Cases*[1]
Enteric	**73**	**1980**	**84.8**
Campylobacteriosis	4	33	1.4
Clostridium difficile	1	3	0.1
Cryptosporidiosis	2	5	0.2
Norovirus	27	1429	61.2
Salmonellosis	7	36	1.5
Shiga-toxin producing *Escherichia coli* (STEC)	1	56	2.4
Shigellosis	5	24	1.0
Unknown Etiology	26	394	16.9
Legionellosis	**2**	**17**	**0.7**
Other	**4**	**136**	**5.8**
Fifth Disease	1	81	3.5
Impetigo	2	50	2.1
Methicillin-Resistant *Staphylococcus aureus*	1	5	0.2
Unknown	**1**	**19**	**0.8**
Vaccine Preventable	**8**	**183**	**7.8**
Influenza	4	147	6.3
Mumps	2	23	1.0
Pertussis	2	13	0.6
Total	88	2335	

[1]The percentage of total outbreak cases was calculated using the number of disease-specific outbreak cases and the total number of outbreak cases

Certain types of outbreaks are more common during specific times of the calendar year. The graph below depicts 2016 outbreaks by the month in which they were reported and the category in which the causative agent was found, Figure 1.

Figure 1: Confirmed Outbreaks by Category and Month, Kansas, 2016



SECTION I: DISEASE SUMMARIES

ACUTE FLACCID MYELITIS

CLINICAL FEATURES: An illness with a sudden onset of acute focal limb weakness. Most patients develop sudden onset of limb weakness and loss of muscle tone and reflexes. Other symptoms associated with this syndrome are: facial droop/weakness, difficulty moving eyes, drooping eyelids, difficulty swallowing, or slurred speech.

CAUSATIVE AGENT: Acute flaccid myelitis can be caused by a variety of pathogens including: adenoviruses, enteroviruses, herpesviruses, cytomegalovirus, Epstein-Barr virus, and West Nile virus (WNV) and viruses in the same family as WNV.

MODE OF TRANSMISSION: The mode of transmission is dependent upon the agent, it may include person-to-person via fecal-oral and/or respiratory secretions, or vector-borne through the bite of an arthropod.

INCUBATION PERIOD: The incubation period is agent dependent.

PERIOD OF COMMUNICABILITY: The period of communicability is not clearly defined. As long as the agent is excreted from bodily fluids or present in blood the disease is considered communicable.

PUBLIC HEALTH SIGNIFICANCE: Acute flaccid myelitis is an emerging condition that most frequently occurs in children and adolescents. The goal of public health surveillance in Kansas is to increase awareness of acute flaccid myelitis and collect as much information as possible to better identify risk factors and etiologic agents. Disease may be prevented by promotion of good hygienic practices, such as washing one's hands often with soap and water, avoiding close contact with sick people, and cleaning surfaces with a disinfectant.

REPORTABLE DISEASE IN KANSAS SINCE: Reportable as a newly recognized disease

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An illness with acute onset of focal limb weakness, and an MRI showing spinal cord lesions largely restricted to gray matter and spanning one or more spinal segments.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Cerebrospinal fluid with pleocytosis (white blood cell count >5 mm3, adjusting for presence of red blood cells by subtracting 1 white blood cell for every 500 red blood cells present).

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - An illness with acute onset of focal limb weakness, ***AND***
    - An MRI showing a spinal cord lesion largely restricted to gray matter and spanning one or more spinal segments

- *Probable:*
  - An illness with acute onset of focal limb weakness, ***AND***
    - Cerebrospinal fluid with pleocytosis (white blood cell count >5 mm3, adjusting for presence of red blood cells by subtracting 1 white blood cell for every 500 red blood cells present).

EPIDEMIOLOGY AND TRENDS

Two confirmed cases of acute flaccid myelitis were reported during 2016. Both of the cases were hospitalized; there were no reported deaths. The two cases occurred in persons younger than 18 years of age.

Confirmed Cases: 2

Kansas incidence per 100,000 population (2016): 0.07
U.S. incidence per 100,000 population (2015): *N/A*

AMEBIASIS

CLINICAL FEATURES: There are two forms of amebiasis: intestinal and extraintestinal. The intestinal form of the disease is usually asymptomatic, but symptoms can range from acute mild abdominal discomfort to chronic diarrhea and fulminating dysentery. Fever, chills, and bloody mucoid diarrhea may also be present. Diarrheal episodes may alternate with periods of constipation or remission. The extraintestinal form appears in severe cases, often characterized by amebic liver abscesses. Infection also may be asymptomatic.

CAUSATIVE AGENT: The protozoan parasite *Entamoeba histolytica*.

MODE OF TRANSMISSION: *E. histolytica* predominantly infects humans and other primates. Transmission among humans most often occurs through ingestion of chlorine-resistant amebic cysts present in fecally contaminated water or food. Oral-anal sexual contact is also a risk factor for infection.

INCUBATION PERIOD: Onset of symptoms usually occurs 2 to 4 weeks after infection, but this may be variable.

PERIOD OF COMMUNICABILITY: Infection may occur as long as cysts are present in stool, which may continue for years.

PUBLIC HEALTH SIGNIFICANCE: Amebiasis is of public health concern due to the prolonged shedding period and the severe complications that may develop, usually involving the liver. Immunocompromised persons are also at increased risk of developing the severe form of disease. Treatment is available for both intestinal and extraintestinal amebiasis.

REPORTABLE DISEASE IN KANSAS SINCE: 1982.

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Infection of the large intestine by *Entamoeba histolytica* may result in an illness of variable severity ranging from mild, chronic diarrhea to fulminant dysentery. Extraintestinal infection also can occur (e.g., hepatic abscess).

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Intestinal amebiasis
  - Demonstration of cysts or trophozoites of *E. histolytica* in stool or
  - Demonstration of trophozoites in tissue biopsy or ulcer scrapings by culture or histopathology

- Extraintestinal amebiasis
  - Demonstration of *E. histolytica* trophozoites in extraintestinal tissue

SURVEILLANCE CASE DEFINITIONS

- *Confirmed, intestinal amebiasis*:
  - A clinically compatible illness that is laboratory confirmed. Asymptomatic intestinal carriage of *E. histolytica* should not be reported.

- *Confirmed, extraintestinal amebiasis*:
  - A parasitologically confirmed infection of extraintestinal tissue, or among symptomatic persons (with clinical or radiographic findings consistent with extraintestinal infection), demonstration of specific antibody against *E. histolytica* as measured by indirect hemagglutination or other reliable immunodiagnostic test (e.g., enzyme-linked immunosorbent assay). Among asymptomatic persons, a positive serologic test does not necessarily indicate extraintestinal amebiasis.

EPIDEMIOLOGY AND TRENDS

One confirmed case of intestinal amebiasis was reported during 2016. The three-year median for 2013-2015 was four cases. Infections are not tracked nationally — no comparable U.S. rate is available.

Confirmed Cases: 1

Kansas incidence per 100,000 population (2016):	0.03
U.S. incidence per 100,000 population (2015):	*N/A*

ARBOVIRAL DISEASE

(Includes West Nile, Western equine, California serogroup, Eastern equine, Powassan, St. Louis, La Crosse arboviruses, and Chikungunya)

CLINICAL FEATURES: Arboviral infections may be asymptomatic or may result in illness of variable severity, sometimes associated with central nervous system (CNS) involvement. When the CNS is affected, clinical syndromes ranging from febrile headache to aseptic meningitis to encephalitis may occur. West Nile virus (WNV) presents clinical features similar to other causative agents of meningitis and encephalitis.

CAUSATIVE AGENT: Arboviruses, including West Nile, Western equine, Eastern equine, Powassan, St. Louis, La Crosse, and Chikungunya.

MODE OF TRANSMISSION: Arboviruses are transmitted by the bite of an infected mosquito. Natural transmission involves a mosquito-bird-mosquito cycle; animals such as humans and horses do not circulate enough virus to re-infect a blood-feeding mosquito, and thus are referred to as "dead-end" or "accidental" hosts. Mosquito species responsible for transmission vary by region. Chikungunya virus occurs after mosquitoes become infected when they feed on a person already infected with the virus. Infected mosquitoes can then spread the virus to other people through bites.

INCUBATION PERIOD: The incubation period for arboviral diseases varies. For West Nile virus, the incubation period ranges from 3 to 15 days (usually 6 days). For Chikungunya, the incubation period ranges from 3 to 7 days.

PERIOD OF COMMUNICABILITY: Human-to-human transmission is exceptionally rare, but has occurred among blood and organ recipients.

PUBLIC HEALTH SIGNIFICANCE: The role of public health is limited to surveillance and education. Prevention is accomplished through adopting personal behaviors to prevent being bitten by mosquitoes, and through destroying mosquito breeding sites.

REPORTABLE DISEASE IN KANSAS SINCE: 2002

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

Neuroinvasive disease

- Fever (≥100.4°F or 38°C) or chills as reported by the patient or a health-care provider, ***AND***
- Meningitis, encephalitis, acute flaccid paralysis, or other acute signs of central or peripheral neurologic dysfunction, as documented by a physician, ***AND***
- Absence of a more likely clinical explanation.

Non-neuroinvasive disease

- Fever (≥100.4°F or 38°C) or chills as reported by the patient or a health-care provider, ***AND***
- Absence of neuroinvasive disease, ***AND***
- Absence of a more likely clinical explanation.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, ***OR***
- Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, ***OR***
- Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, ***OR***
- Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred, ***OR***
- Virus-specific IgM antibodies in CSF or serum.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*

  Neuroinvasive disease

  - A case that meets the above clinical criteria for neuroinvasive disease and one or more the following laboratory criteria for a confirmed case:
    - Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, ***OR***
    - Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, ***OR***
    - Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, ***OR***
    - Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

  Non-neuroinvasive disease

  - A case that meets the above clinical criteria for non-neuroinvasive disease and one or more of the following laboratory criteria for a confirmed case:
    - Isolation of virus from, or demonstration of specific viral antigen or nucleic acid in, tissue, blood, CSF, or other body fluid, ***OR***
    - Four-fold or greater change in virus-specific quantitative antibody titers in paired sera, ***OR***
    - Virus-specific IgM antibodies in serum with confirmatory virus-specific neutralizing antibodies in the same or a later specimen, ***OR***

- Virus-specific IgM antibodies in CSF and a negative result for other IgM antibodies in CSF for arboviruses endemic to the region where exposure occurred.

➢ *Probable:*

Neuroinvasive disease

- A case that meets the above clinical criteria for neuroinvasive disease and the following laboratory criteria:
  - Virus-specific IgM antibodies in CSF or serum but with no other testing.

Non-neuroinvasive disease

- A case that meets the above clinical criteria for non-neuroinvasive disease and the following laboratory criteria:
  - Virus-specific IgM antibodies in CSF or serum but with no other testing.

EPIDEMIOLOGY AND TRENDS

WEST NILE VIRUS

In 2016, there were 2 confirmed and 15 probable cases of neuroinvasive West Nile virus (WNV) and 2 confirmed and 18 probable cases of non-neuroinvasive WNV. The median age was 59 years (range 26 – 88 years). Twenty-five cases (67.6%) were hospitalized. Five deaths (13.5%) were identified.

The earliest cases were reported in June. The majority (35%, n=13) of cases occurred in August, followed by September (n=9), July (n=7), October (n=5), and June (n=3).

Confirmed and Probable Cases: 37

West Nile virus neuroinvasive incidence

Kansas incidence per 100,000 population (2016):	0.58
U.S. incidence per 100,000 population (2015):	0.45

WEST NILE VIRUS MOSQUITO SURVEILLANCE

During 2016, the Kansas Biological Survey partnered with the Sedgwick County Health Department and the Kansas Department of Health and Environment to conduct mosquito surveillance in Sedgwick County. Mosquito surveillance was conducted from May 17 to October 25, 2016 and potential vector mosquitoes were tested for West Nile virus at the Kansas Health and Environmental Laboratories. Mosquitoes were pooled for testing with up to 50 mosquitoes included per vial. A total of 150 mosquito pools were tested for West Nile virus: two (1.3%) tested positive. The WNV-positive pool was collected on August 26 and September 30, 2016.

For more information on West Nile Virus surveillance in 2016, see the 2016 Arboviral Disease Surveillance Report.

CHIKUNGUNYA VIRUS

In 2016, there was 1 probable case of Chikungunya reported. The patient was an adult. This case was travel-associated.

Confirmed and Probable Cases: 1

Kansas incidence per 100,000 population (2016):	0.03
U.S. incidence per 100,000 population (2015):	*N/A*

ARBOVIRAL DISEASE, OTHER

In 2016, no cases of arboviral disease, other cases were identified.

Confirmed and Probable Cases: 0

Kansas incidence per 100,000 population (2016):	0.00
U.S. incidence per 100,000 population (2015):	*N/A*

BRUCELLOSIS

CLINICAL FEATURES: Acute or insidious onset of intermittent or irregular fever, chills, profuse night sweats, weakness, profound fatigue, depression, weight loss, arthralgia and generalized aching. Localized suppurative infections of organs, including liver and spleen, as well as chronic localized infections may occur. Subclinical disease has been reported. Symptoms may last for weeks, months, or years if not adequately treated.

CAUSATIVE AGENT: *Brucella* spp., small gram-negative coccobacilli. Generally caused by *B. abortus, B. melitensis, B. suis,* and rarely *B. canis*.

MODE OF TRANSMISSION: Several animals are reservoirs, including cattle, sheep, goats, pigs, bison, elk, deer, caribou, and dogs. Transmission occurs through breaks in skin after direct contact with an infected animal's tissues, blood, urine, vaginal discharges, placenta, or aborted fetuses. Ingestion of unpasteurized milk or dairy products from an infected animal may also transmit the disease. Inhalation of aerosols has resulted in transmission among animals in pens and stables and with humans in laboratories. Accidental self-inoculation of animal vaccine strains has resulted in a few cases. Rare instances of transmission through human breast milk and sexual contact have been documented.

INCUBATION PERIOD: Highly variable, usually 5-60 days but occasionally several months.

PERIOD OF COMMUNICABILITY: As long as the agent is in an animal's tissues or body fluids. Person-to-person transmission does not occur.

PUBLIC HEALTH SIGNIFICANCE: Brucellosis is a disease that has been nearly eliminated in the U.S. because of vigorous animal health control measures and milk pasteurization. The United States Department of Agriculture (USDA) considers Kansas to be a brucellosis free state. *Brucella* may be used as a biological weapon; however, routine case investigations focus on contaminated dairy products.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An illness characterized by acute or insidious onset of fever, night sweats, undue fatigue, anorexia, weight loss, headache, and arthralgia.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Definitive*
  - Culture and identification of *Brucella* spp. from clinical specimens
  - Evidence of a fourfold or greater rise in *Brucella* antibody titer between acute- and convalescent-phase serum specimens obtained greater than or equal to 2 weeks apart

- *Presumptive*
  - *Brucella* total antibody titer of greater than or equal to 160 by standard tube agglutination test (SAT) or *Brucella* microagglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms
  - Detection of *Brucella* DNA in a clinical specimen by PCR assay

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A clinically compatible illness with definitive laboratory evidence of Brucella infection

- *Probable:*
  - A clinically compatible illness with at least one of the following:
    - Epidemiologically linked to a confirmed human or animal brucellosis case
    - Presumptive laboratory evidence, but without definitive laboratory evidence, of *Brucella* infection

EPIDEMIOLOGY AND TRENDS

Two cases of brucellosis, one confirmed and one probable, were reported in Kansas in 2016. From 2006 to 2015 a total of six cases have been reported. There were four to five exposed during the laboratory testing of specimens. Each exposed laboratorian was recommended to receive appropriate post exposure prophylaxis and serological monitoring to ensure no rise in titer for seroconversion. No additional cases resulted from laboratory exposures.

Confirmed and Probable Cases: 2

Kansas incidence per 100,000 population (2016): 0.07
U.S. incidence per 100,000 population (2015): 0.04

CAMPYLOBACTERIOSIS

CLINICAL FEATURES: An illness characterized by diarrhea, abdominal pain, malaise, fever, nausea, and vomiting. Stools may contain visible or occult blood. Clinical manifestations from *Campylobacter* can range from mild infections lasting 1 to 2 days to severe persistent infections. Occasionally, long-term consequences may result from infection, including Guillain-Barré syndrome (GBS), a rare disease that affects the nervous system.

CAUSATIVE AGENT: *Campylobacter* spp., a gram-negative bacterium, most commonly *Campylobacter jejuni*.

MODE OF TRANSMISSION: Occurs after ingestion of contaminated liquids (particularly untreated water or unpasteurized milk and juices) or food (undercooked chicken or pork). Direct contact with fecal material from infected animals and person-to-person contact are less frequent causes of infection. Reservoirs include animals, most commonly poultry and cattle. Puppies, kittens, other pets, swine, sheep, rodents, and birds may also be sources of human infection. Chronic infection of poultry and other animals constitutes the primary source of infection.

INCUBATION PERIOD: 1 to 10 days (average 2 to 5 days)

PERIOD OF COMMUNICABILITY: Throughout the course of infection; usually from several days to several weeks; can last from 2 to 7 weeks if not treated with antibiotics.

PUBLIC HEALTH SIGNIFICANCE: *Campylobacter* spp. are an important cause of diarrheal illness in all parts of the world and in all age groups. Common source outbreaks have occurred, most often associated with foods, especially undercooked chicken, unpasteurized milk, and non-chlorinated water.

REPORTABLE DISEASE IN KANSAS SINCE: 1990

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Isolation of *Campylobacter* spp. from a clinical specimen

- *Laboratory probable*:
  - Detection of *Campylobacter* spp. in a clinical specimen using a culture independent diagnostic test (CIDT)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that meets the confirmed laboratory criteria for diagnosis.

- *Probable:*
  - A clinically compatible illness that is epidemiologically linked to a probable or confirmed case, ***OR***
  - A case that meets the probable laboratory criteria for diagnosis

EPIDEMIOLOGY AND TRENDS

In 2015, the case definition for campylobacteriosis was changed to include a more encompassing definition for a probable case. Before 2015, an illness which was identified through the detection of *Campylobacter* spp. in a clinical specimen using culture independent diagnostic testing (CIDT) was not classified as a probable or confirmed case. As of 2015, cases identified using CIDT methods are classified as probable cases. This change in case definition resulted in a large increase in the number of reported cases and does not necessarily indicate an increase in the incidence of campylobacteriosis in Kansas, Figure 2.

In 2016, 343 confirmed and 425 probable cases of campylobacteriosis were reported in Kansas, resulting in a total of 768 cases. The Kansas incidence for 2016 was 26.4 per 100,000 compared to the U.S. incidence of 17.7 per 100,000 in 2015.

Confirmed and probable cases ranged in age from less than one year to 96 years. The median age was 42 years. The highest incidence occurred in those under 5 years of age (41.7 per 100,000), Figure 3.

Residents of nonurban counties accounted for 406 (53%) of the confirmed and probable cases, Figure 4.

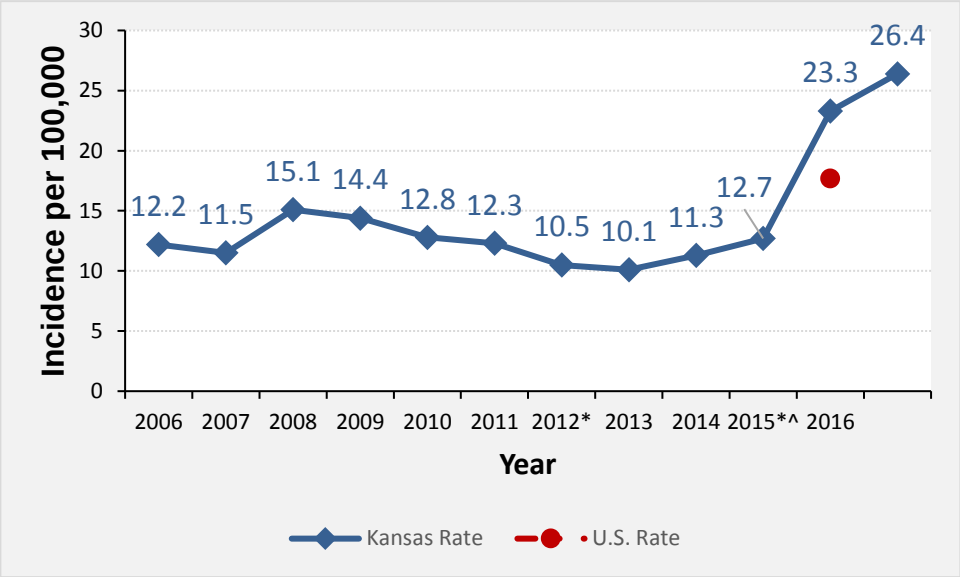
Campylobacteriosis is seasonal with the highest number of cases reported in the summer months between June and August, Figure 5.

Common exposures include international travel and ingesting untreated water, Table 2. Consumption of unpasteurized milk or other dairy products can also cause campylobacteriosis.

Confirmed and Probable Cases: 768

Kansas incidence per 100,000 population (2016): 26.42
U.S. incidence per 100,000 population (2015): 17.68

Figure 2 Campylobacteriosis incidence per 100,000 population by year, 2006 – 2016



**Case definition change*
^Reportable in the US

Figure 3 Campylobacteriosis incidence by age group per 100,000 population, Kansas, 2016

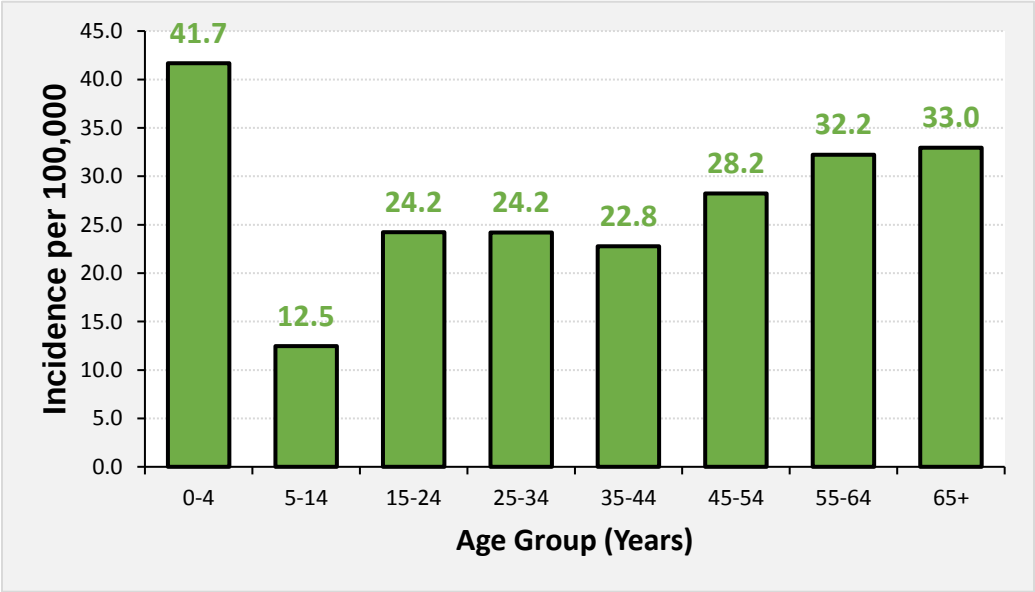


Figure 4 Campylobacteriosis incidence by County Urbanicity per 100,000 population, Kansas, 2016

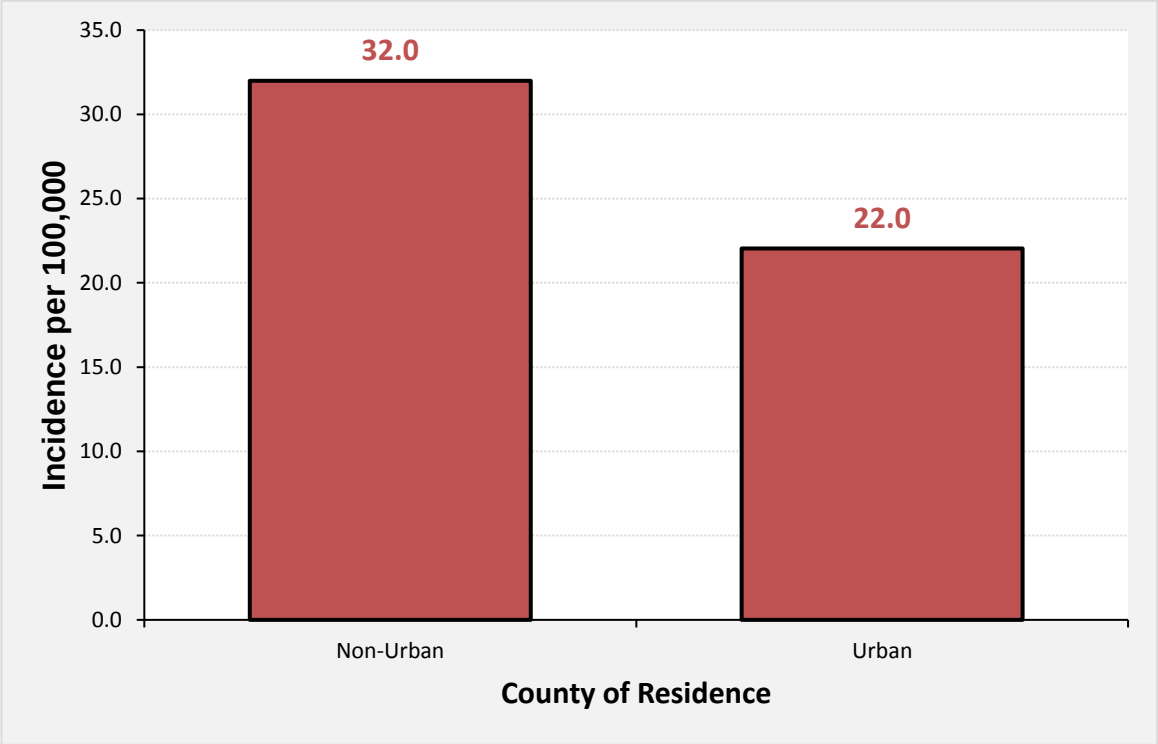


Figure 5 Campylobacteriosis cases per month Kansas, 2016

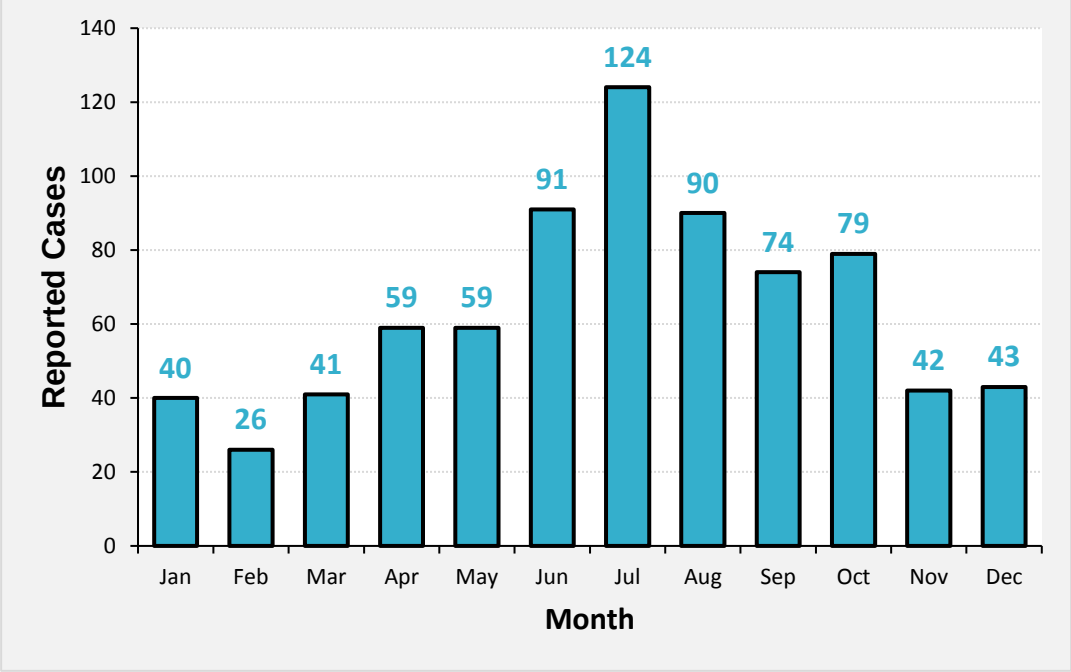


Table 2 Potential Exposures

Exposures	# Exposed / Total # Respondents	Percent
Consumption of raw milk	6/585	1.0%
Consumption of unpasteurized cheese	8/571	1.4%
Ingesting untreated water	37/567	6.5%
International Travel	43/611	7.0%

CHAGAS DISEASE

CLINICAL FEATURES: There are two phases of Chagas disease. The acute phase lasts for the first few weeks or months of infection. Infection may be mild or asymptomatic. Common symptoms include fever, fatigue, body aches, headache, and rash. The signs on physical examination can include mild enlargement of the liver or spleen, swollen glands, and local swelling where the parasite entered the body. The most recognized marker of acute Chagas disease is called Romaña's sign, which includes swelling of the eyelids on the side of the face near the bite wound or where the bug feces were deposited or accidentally rubbed into the eye. During the chronic phase, the infection may remain silent for decades or even for life. However, some people develop:

- **cardiac complications**, which can include an enlarged heart (cardiomyopathy), heart failure, altered heart rate or rhythm, and cardiac arrest (sudden death); and/or
- **intestinal complications**, which can include an enlarged esophagus (megaesophagus) or colon (megacolon) and can lead to difficulties with eating or with passing stool.

CAUSATIVE AGENT: Protozoan *Trypanosoma cruzi*

MODE OF TRANSMISSION: Infection is most commonly acquired through contact with the feces of an infected triatomine bug (or "kissing bug"), a blood-sucking insect that feeds on humans and animals. Infection can also occur from mother to baby, contaminated blood products, an organ transplanted from an infected donor, laboratory accident, or, rarely, contaminated food or drink.

INCUBATION PERIOD: The incubation period of vector-borne acute Chagas disease is thought to be 7-14 days.

PERIOD OF COMMUNICABILITY: Human-to-human transmission is exceptionally rare but has occurred among blood and organ recipients.

PUBLIC HEALTH SIGNIFICANCE: The role of public health is limited to surveillance and education. Prevention is accomplished through adopting personal behaviors to prevent being bitten by triatomine bugs.

REPORTABLE DISEASE IN KANSAS SINCE: Chagas disease is not explicitly reportable in Kansas; however, it is reported under the exotic or newly recognized disease clause.

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES:

NOTE: *Chagas disease does not have a national case definition. Texas' case definition will be used for case classification.*

- The acute phase is characterized by the first 8 weeks of infection, detectable parasitemia, and asymptomatic (most common) or symptomatic manifestations of disease which can include any of the following:
  - Fever, malaise, rash, body aches, headaches, loss of appetite, vomiting, diarrhea, hepatomegaly, splenomegaly, lymphadenopathy, Chagoma (nodular swelling at site

of inoculation), Romaña's sign (unilateral swelling of the eyelid) and rarely, acute myocarditis and/or meningoencephalitits

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed:*
  - Detection of antibody specific to T. cruzi by **TWO** distinct diagnostic tests performed at Centers for Disease Control and Prevention
    - Tests currently in use at CDC include:
      - Trypanosoma cruzi AB EIA
      - Trypanosoma cruzi AB IB (TESA)

- *Laboratory supportive*:
  - Positive diagnostic serology for T. cruzi antibodies, ***OR***
  - Positive blood donor screening test PLUS a positive supplemental test

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case (asymptomatic or symptomatic) that has confirmatory laboratory testing

- *Probable:*
  - A clinically compatible case with supportive laboratory testing and documented exposure within 8 weeks of illness onset or diagnosis

EPIDEMIOLOGY AND TRENDS

In 2016, one Chagas case was reported in Kansas. This case is the third case identified in Kansas; the most recent case had unknown travel history. The previous two cases were potentially travel-associated.

Confirmed and Probable Cases: 1

Kansas incidence per 100,000 population (2016): 0.03
U.S. incidence per 100,000 population (2015): N/A

CRYPTOSPORIDIOSIS

CLINICAL FEATURES: An illness characterized by profuse, watery diarrhea. Other symptoms that may appear include abdominal cramps, loss of appetite, weight loss, low-grade fever, nausea, and vomiting. Symptoms usually last 1 to 2 weeks. Occasionally symptoms will wax and wane for up to 30 days. Asymptomatic infections also occur.

CAUSATIVE AGENT: *Cryptosporidium* spp., a spore-forming coccidian protozoan. *C. parvum* and *C. hominis* are the most common species affecting humans.

MODE OF TRANSMISSION: Transmission occurs person-to-person, animal-to-person, waterborne and foodborne via the fecal-oral route. Reservoirs include humans, cattle, and other domestic animals.

INCUBATION PERIOD: 1 to 12 days (average 7 days)

PERIOD OF COMMUNICABILITY: As long as oocysts are present in the stool. Oocysts may be shed in stool from the onset of symptoms to several weeks after symptoms resolve.

PUBLIC HEALTH SIGNIFICANCE: *C. parvum* has been the cause of several large waterborne outbreaks (drinking and recreational) in recent decades. The oocysts are highly resistant to normal amounts of chemical disinfectants, including chlorine, and filtration is needed to remove the oocysts from public water supplies.

With a low infectious dose (as low as 10 organisms) and a long shedding period (sometimes up to 2 months), cryptosporidiosis is extremely contagious and may be easily transmitted person-to-person. Attack rates of 30% to 60% have been reported in outbreaks associated with childcare centers.

Though all individuals are at risk for infection, young children and pregnant women may be more susceptible to dehydration. Illness among immunocompromised individuals, especially persons with HIV/AIDS, may be life-threatening.

REPORTABLE DISEASE IN KANSAS SINCE: 1997

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES:

- *Laboratory confirmed:*
  - Evidence of *Cryptosporidium* organisms or DNA in stool, intestinal fluid, tissue samples, biopsy specimens, or other biological sample by certain laboratory methods with a high positive predictive value (PPV), e.g.,
    - Direct fluorescent antibody [DFA] test,
    - Polymerase chain reaction [PCR],
    - Enzyme immunoassay [EIA], **OR**
    - Light microscopy of stained specimen.

- *Laboratory probable*:
  - The detection of *Cryptosporidium* antigen by a screening test method, such as immunochromatographic card/rapid card test; or a laboratory test of unknown method.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - A case that is diagnosed with *Cryptosporidium* spp. infection based on laboratory testing using a method listed in the confirmed criteria.

- *Probable:*
  - A case with supportive laboratory test results for *Cryptosporidia* spp. infection using a method listed in the probable laboratory criteria, ***OR***
  - A case that meets the clinical criteria and is epidemiologically linked to a confirmed case.

EPIDEMIOLOGY AND TRENDS

In 2016, 133 confirmed and probable cryptosporidiosis cases were reported among Kansas residents. The three-year median from 2013-2015 was 122 cases, Figure 6. The highest incidence rate occurred in those under 5 years of age and those 15 to 24 years old (6.7 per 100,000), Figure 7. Thirty-six (30%) cases were hospitalized, and two (1%) deaths were reported.

Contact with animals was the most reported exposure followed by manure and contact with recreational water, Table 3.

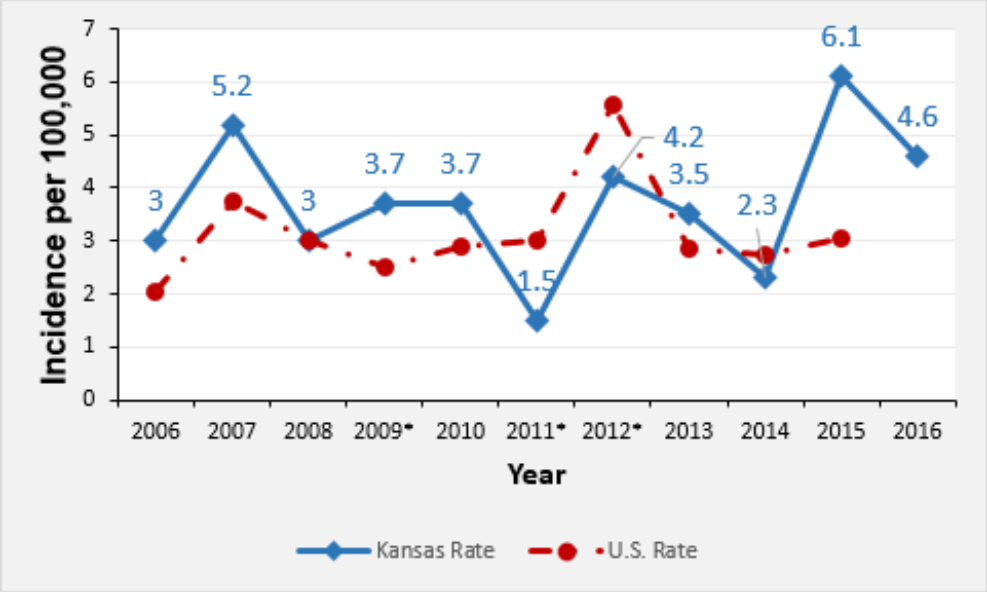
Confirmed and Probable Cases: 133

Kansas incidence per 100,000 population (2016): 4.57
U.S. incidence per 100,000 population (2015): 3.03

Table 3 Potential Exposures

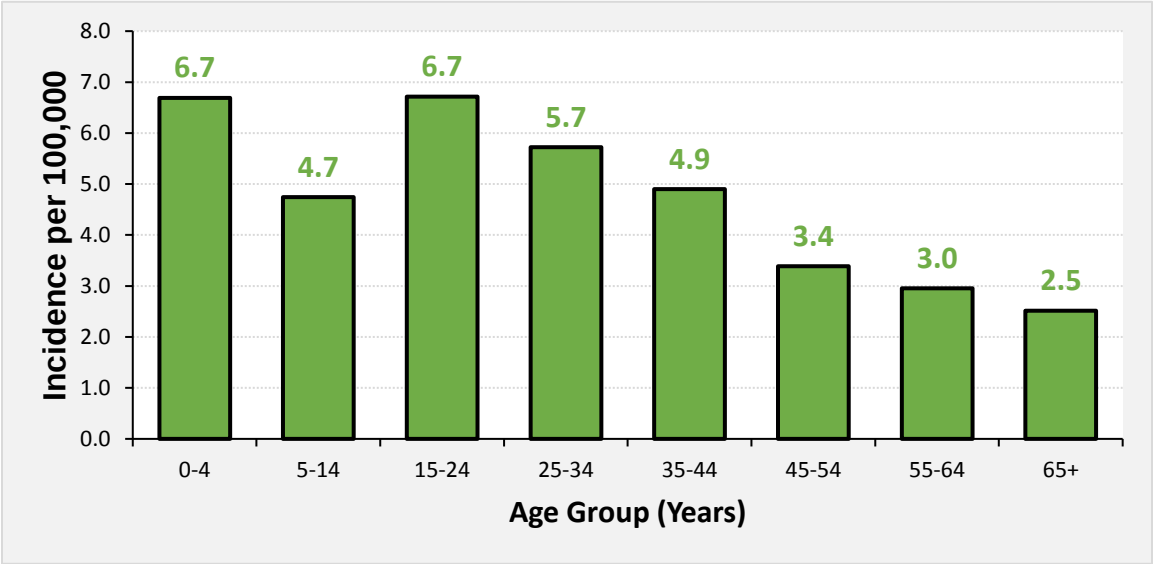
Exposures	# Exposed / Total # Respondents	Percent
Contact with Animals	80/106	75.5%
Contact with Manure	31/105	29.5%
Swimming or Wading in Recreational Water	17/107	15.9%

Figure 6 Cryptosporidiosis incidence per 100,000 population by year, 2006 – 2016



**Case definition change*

Figure 7 Cryptosporidiosis incidence per 100,000 population, Kansas, 2016



CYCLOSPORIASIS

CLINICAL FEATURES: An illness characterized by profuse, watery diarrhea. Other common symptoms include loss of appetite, weight loss, abdominal cramps, bloating, nausea, body aches, and fatigue. Vomiting and low-grade fever may also be present. Without treatment, symptoms can persist for several weeks to a month or longer. Symptoms may seem to resolve and then return one or more times before complete recovery. Asymptomatic infections also occur.

CAUSATIVE AGENT: *Cyclospora cayetanensis*, a protozoan parasite

MODE OF TRANSMISSION: Transmission occurs by ingestion of sporulated oocysts, the infective form of the parasite, in water or food contaminated with feces of an infected animal. An infected person or animal sheds unsporulated (immature, non-infective) *Cyclospora* oocysts in the feces. The oocysts are thought to require days to weeks in favorable environmental conditions to sporulate (become infective). Therefore, direct person-to-person transmission is unlikely, as is transmission via ingestion of newly contaminated food or water.

INCUBATION PERIOD: 2 days to more than 2 weeks (average 7 days)

PERIOD OF COMMUNICABILITY: Direct person-to-person transmission is unlikely; infected persons can shed organisms in their stool for up to a month, but these organisms are not infectious and require time in the environment to mature and sporulate before they are capable of causing infection.

PUBLIC HEALTH SIGNIFICANCE: Cyclosporiasis represents a growing burden of foodborne disease in the United States. Americans traveling to tropical or subtropical regions where *Cyclospora* is endemic may be at increased risk for illness; cases not associated with travel are often associated with imported fresh produce.

REPORTABLE DISEASE IN KANSAS SINCE: 2005

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An illness of variable severity caused by the protozoan parasite *Cyclospora cayetanensis*. The most common symptom is watery diarrhea. Other common symptoms include loss of appetite, weight loss, abdominal cramps/bloating, nausea, body aches, and fatigue. Vomiting and low grade fever also may be noted.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed:*
  - The detection of *Cyclospora* organisms or DNA in stool, intestinal fluid/aspirate, or intestinal biopsy specimens.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - A case that meets the clinical description and at least one of the criteria for laboratory confirmation as described above.

- *Probable:*
  - A case that meets the clinical description and is epidemiologically linked to a confirmed case.

EPIDEMIOLOGY AND TRENDS

Although cyclosporiasis has been reportable in Kansas since 2003, the first cases in Kansas were reported in 2013. In 2016, 10 confirmed cases of cyclosporiasis were reported in the state of Kansas. The three-year median for 2012-2014 was four cases.

Confirmed and Probable Cases: 10

Kansas incidence per 100,000 population (2016):	0.34
U.S. incidence per 100,000 population (2015):	0.22

DENGUE FEVER/DENGUE HEMORRHAGIC FEVER

CLINICAL FEATURES: Illness can range from a mild, non-specific febrile syndrome (dengue-like illness) to classic dengue fever (DF), to rare but potentially fatal forms of the disease, dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).

Classic DF is an acute febrile illness characterized by frontal headache; retro-ocular pain; muscle, bone, and joint pain; and rash. Mild bleeding of nose or gums or easy bruising may be noticed.

DHF may manifest after 2-7 days febrile phase. After the fever is gone, symptoms including persistent vomiting, severe abdominal pain, and difficulty breathing, may develop at the beginning of a critical phase where the capillaries are excessively permeable with plasma leaking into the peritoneum and pleural cavity.

The critical phase is marked by a low platelet count and hemorrhagic manifestations, tendency to bruise easily or other types of skin hemorrhages, bleeding nose or gums, and possibly internal bleeding.

CAUSATIVE AGENT: The viruses of dengue fever are flaviviruses. The same viruses are responsible for dengue hemorrhagic fever.

MODE OF TRANSMISSION: Bite of infected mosquitoes, principally *Aedes aegypti*. This is a day-biting species, with increased biting activity for 2 hours after sunrise and several hours before sunset.

INCUBATION PERIOD: In humans, symptoms of infection usually begin 4-7 days after the mosquito bite. After entering the mosquito in the blood meal, the virus requires 8-12 days incubation before it can then be transmitted to another human.

PERIOD OF COMMUNICABILITY: Humans transmit virus to mosquitoes during a 3-5 day period usually shortly before the end of the febrile period.

PUBLIC HEALTH SIGNIFICANCE: The role of public health is limited to surveillance and education. Prevention is accomplished through adopting personal behaviors to prevent being bitten by mosquitoes and through destroying mosquito breeding sites.

REPORTABLE DISEASE IN KANSAS SINCE: Not explicitly reportable in Kansas, however, falls under the exotic or newly recognized disease clause.

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Dengue is defined by fever as reported by the patient or healthcare provider and the presence of one or more of the following signs and symptoms:
  - Nausea/vomiting
  - Rash

- Aches and pains
- Tourniquet test positive
- Leukopenia
- Any warning sign for severe dengue:
  - Abdominal pain or tenderness
  - Persistent vomiting
  - Extravascular fluid accumulation
  - Mucosal bleeding at any site
  - Liver enlargement
  - Increasing hematocrit concurrent with rapid decrease in platelet count

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Detection of DENV nucleic acid in serum, plasma, blood, cerebrospinal fluid (CSF), other body fluid or tissue by validated reverse transcriptase-polymerase chain reaction (PCR); ***OR***
  - Detection of DENV antigens in tissue by a validated immunofluorescence or immunohistochemistry assay; ***OR***
  - Detection in serum or plasma of DENV NS1 antigen by a validated immunoassay; ***OR***
  - Cell culture isolation of DENV from a serum, plasma, or CSF specimen; ***OR***
  - Detection or IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic area of the United States without evidence of other flavivirus transmission; ***OR***
  - Detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area without ongoing transmission of another flavivirus, clinical evidence of co-infection with one of these flavivirus, or recent vaccination against a flavivirus; ***OR***
  - IgM anti-DENV seroconversion by validated immunoassay in acute and convalescent serum specimens; ***OR***
  - IgG anti-DENV seroconversion or $\geq$4-fold rise by a validated immunoassay in serum specimens collected >2 weeks apart, and confirmed by a neutralization test with a >4-fold higher end point titer as compared to other flaviviruses tested.

- *Laboratory presumptive*:
  - Detection of IgM anti-DENV by validated immunoassay in a serum specimen or CSF in a person living in a dengue endemic or non-endemic are of the United States with evidence of other flavivirus transmission; ***OR***
  - Detection of IgM anti-DENV in a serum specimen or CSF by validated immunoassay in a traveler returning from a dengue endemic area with ongoing transmission of another flavivirus, clinical evidence of co-infection with one of these flaviviruses, or recent vaccination against a flavivirus.

- *Laboratory suspected*:
  - The absence of IgM anti-DENV by validated immunoassay in a serum or CSF specimen collected <5 days after illness onset and in which molecular diagnostic testing was not performed in patient with and epidemiologic linkage

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A clinically compatible case of dengue-like illness, dengue, or severe dengue with confirmatory laboratory results.

- *Probable:*
  - A clinically compatible case of dengue-like illness, dengue, or severe dengue with laboratory results indicative of probable infection.

- *Suspect:*
  - A clinically compatible case of dengue-like illness, dengue, or severe dengue with an epidemiologic linkage.

EPIDEMIOLOGY AND TRENDS

In 2016, two probable and two confirmed cases of dengue virus infection were reported in Kansas. The median age was 22.5 years (range 17 – 40 years). No cases were hospitalized or died.

Confirmed and Probable Cases: 4

Kansas incidence per 100,000 population (2015):	0.14
U.S. incidence per 100,000 population (2014):	0.29

EHRLICHIOSIS AND ANAPLASMOSIS

CLINICAL FEATURES: Ehrlichiosis and anaplasmosis are infections attributable to different pathogens but with similar signs, symptoms, and clinical courses. All are acute, febrile, bacterial illnesses. The spectrum of disease ranges from subclinical infection to severe, life-threatening, or fatal disease. Symptoms are nonspecific but most commonly include sudden onset of fever, chills, general malaise, headache, muscle and joint pain, sore throat, and sleeplessness. Generalized lymphadenopathy with tenderness of the enlarged lymph nodes is common. Complications may include leukopenia, anemia, and hepatitis. Symptoms typically last 1 to 2 weeks, and recovery generally occurs without sequelae; however, neurologic complications have been reported in some children after severe disease. Fatal infections have also been reported.

CAUSATIVE AGENT: *Ehrlichia spp.,* gram-negative cocci bacteria, including *Ehrlichia chafeensis* and *Ehrlichia ewingii* are the causative agents for Erlichiosis. *Anaplasma* (formerly *Ehrlichia) phagocytophilium* causes anaplasmosis.

MODE OF TRANSMISSION: Ehrlichial infections caused by *Ehrlichia chaffeensis* and *E ewingii* are associated with the bite of the lone star tick (*Amblyomma americanum*). Another tick, *Ixodes scapularis,* is the likely vector of *Anaplasma phagocytophila*. The reservoirs of *E. chaffeensis* and *E. ewingii* ehrlichiosis are white-tailed deer and dogs. The major reservoirs of *A. phagocytophilum* are ruminants, cervids, and field rodents.

INCUBATION PERIOD: 5 to 10 days after a tick bite or exposure (median=9 days)

PERIOD OF COMMUNICABILITY: No evidence of transmission from person to person.

PUBLIC HEALTH SIGNIFICANCE: Limiting exposure to ticks can prevent infection.

REPORTABLE DISEASE IN KANSAS SINCE: 2000

EPIDEMIOLOGY AND TRENDS

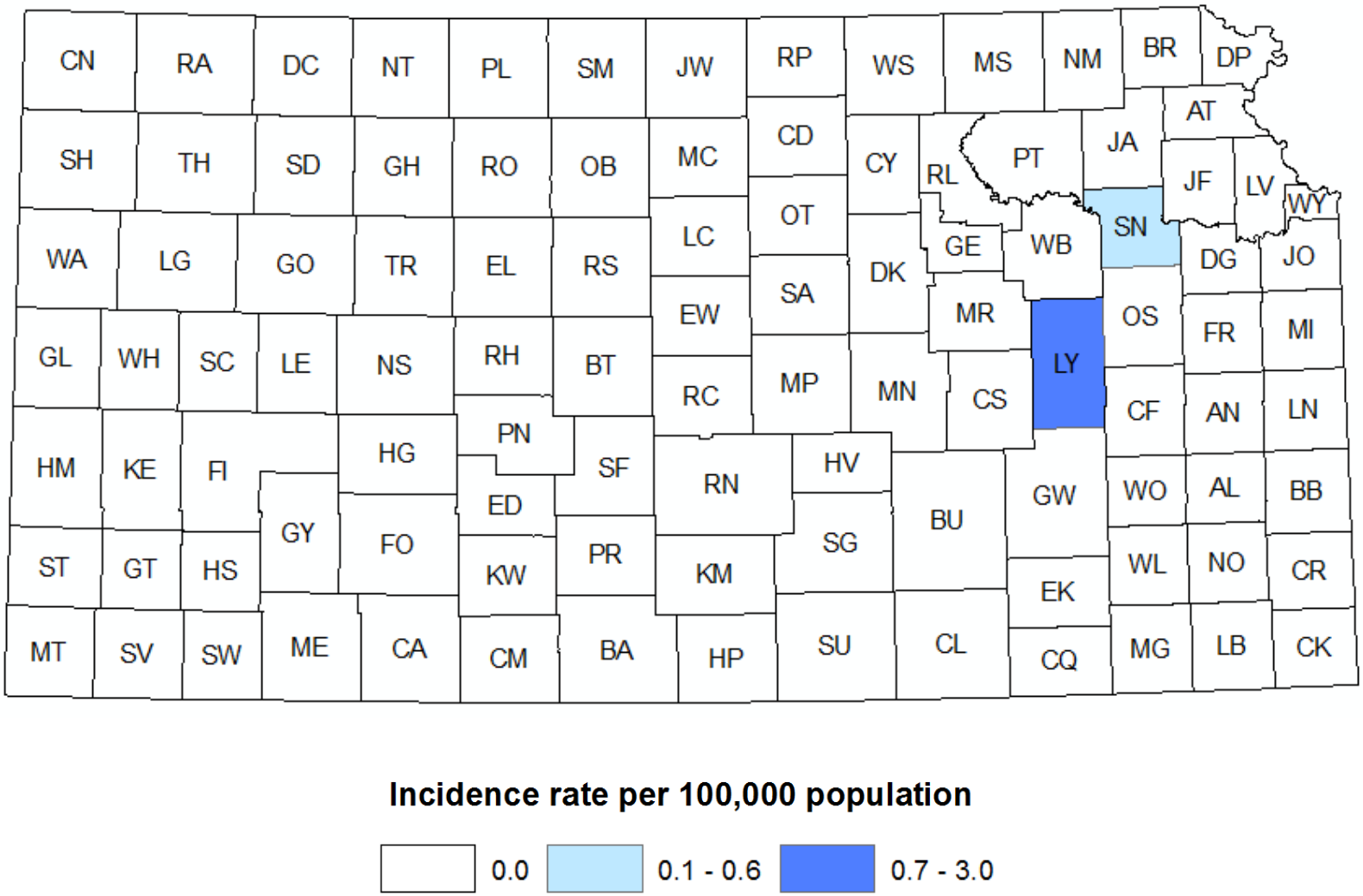
In 2016, 57 confirmed and probable cases of ehrlichiosis and anaplasmosis were reported in Kansas: 51 cases were caused by *Ehrlichia chaffeensis* (19 confirmed cases and 32 probable cases), four by *Anaplasma phagocytophilum* (all probable cases), one by *Ehrlichia ewingii* (a confirmed case), and one probable case which could not be definitively distinguished between ehrlichiosis or anaplasmosis. Twenty-four (42%) cases of ehrlichiosis and anaplasmosis were hospitalized, and no deaths were reported. Cases ranged in age from 7 to 77 years. Thirty-four (70%) cases were age 45 or older. Thirty-seven (60%) cases were male. Among cases with known race (n=54), 52 (96%) were white, and among cases with known ethnicity (n=53), 51 (96%) were non-Hispanic.

Investigation of reported cases of ehrlichiosis and anaplasmosis includes assessment of where the case was most likely bitten by a tick. Of the four cases of anaplasmosis, the most likely Kansas county of exposure was determined for two cases; one exposure was reported outside of Kansas,

and the location of tick exposure could not be determined for one case. Of the 52 ehrlichiosis cases, the most likely Kansas county of exposure was determined for 46 cases; three cases reported tick exposure outside of Kansas, and the location of tick exposure could not be determined for three cases. (The one probable case that could not be distinguished between ehrlichiosis and anaplasmosis was excluded from this analysis.) All Kansas exposures were reported in the eastern half of the state (Figure 8, Figure 9), which corresponds to the known geographic distribution of the tick vectors, *Ambylomma americanum and Ixodes scapularis.*

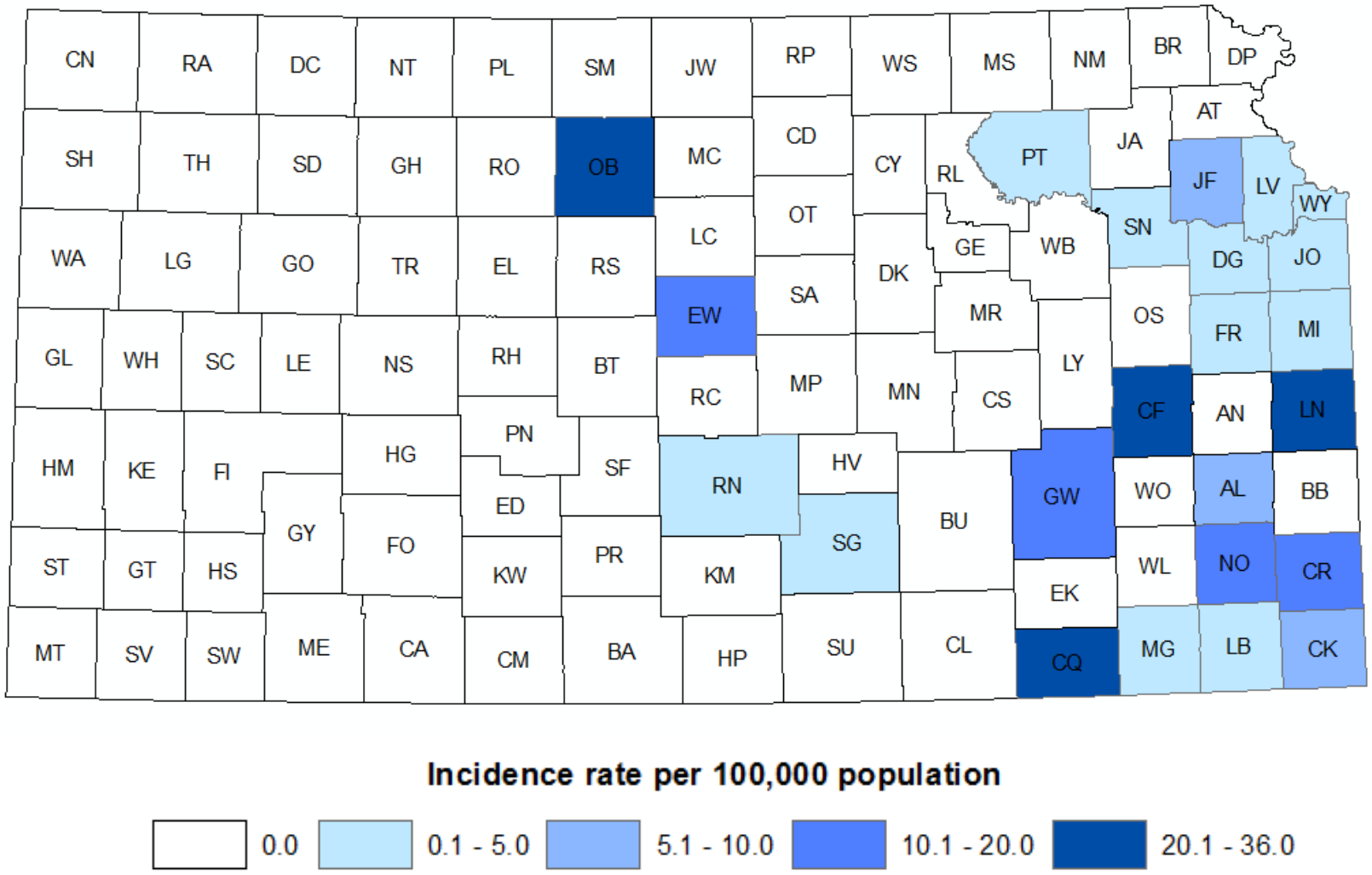
	Ehrlichiosis	**Anaplasmosis**
Confirmed and Probable Cases:	**52**	**4**
Kansas incidence per 100,000 population (2016):	1.78	0.14
U.S. incidence per 100,000 population (2015):	0.42	1.19

Figure 8 Incidence of anaplasmosis per 100,000 population by county of reported tick exposure*, Kansas, 2016 (n=2)



**Incidence was calculated using cases who reported tick exposure in the county and the county's population, rather than the cases' county of residence. Cases whose exposure location was unknown were excluded.*

Figure 9 Incidence of ehrlichiosis per 100,000 population by county of reported tick exposure*, Kansas, 2016 (n=46)



**Incidence was calculated using cases who reported tick exposure in the county and the county's population, rather than the cases' county of residence. Cases whose exposure location was unknown were excluded.*

GIARDIASIS

CLINICAL FEATURES: A gastrointestinal illness characterized by diarrhea, abdominal cramps, bloating, frequent loose and pale stools, malabsorption of fat and fat-soluble vitamins, fatigue, and weight loss. In severe giardiasis, damage to the duodenal and jejunal mucosal cells may occur. Infection is often asymptomatic.

CAUSATIVE AGENT: *Giardia lamblia*, a protozoan parasite

MODE OF TRANSMISSION: Transmission is via the fecal-oral route, primarily through ingestion of contaminated drinking or recreational water, and less often from contaminated food. Person-to-person and animal-to-person transmission can occur. While humans are the principal reservoir of the infection, dogs, cats, beavers, and other animals can also be infected.

INCUBATION PERIOD: Ranges from 3-25 days or longer (average of 7-10 days).

PERIOD OF COMMUNICABILITY: Entire period of infection. *Giardia* is often shed in the stool for months.

PUBLIC HEALTH SIGNIFICANCE: Disease may be prevented by promotion of good hand washing. Institutional outbreaks, especially in child day care centers, may result from person-to-person transmission. Exclusion policies may apply to infected day care enrollees, food workers, and direct patient care providers.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Detection of *Giardia* organisms, antigen, or DNA in stool, intestinal fluid, tissue samples, biopsy specimens or other biological sample.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that meets the clinical description and the criteria for laboratory confirmation as described above. When available, molecular characterization (e.g., assemblage designation) should be reported.

- *Probable:*
  - A case that meets the clinical description and that is epidemiologically linked to a confirmed case.

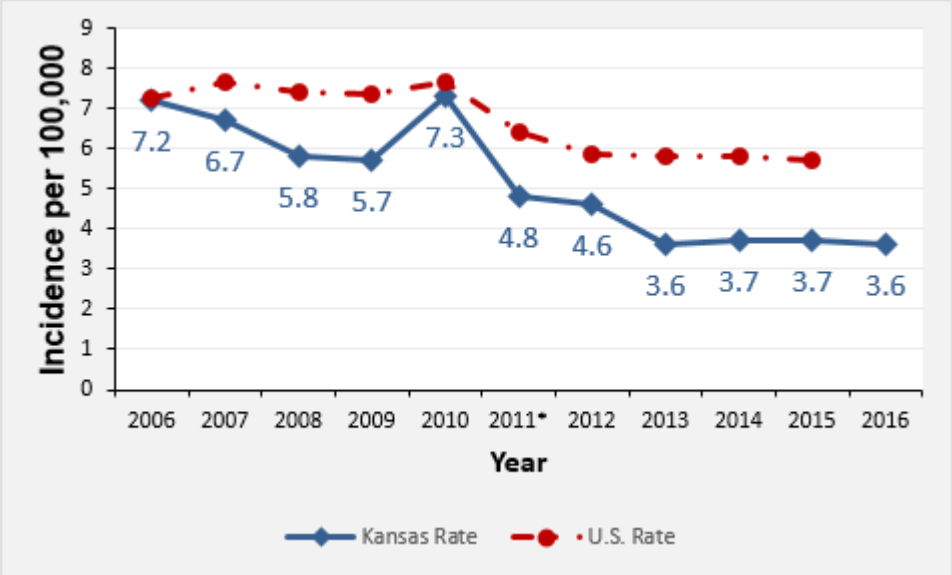
EPIDEMIOLOGY AND TRENDS

In 2016, 104 confirmed and probable cases were reported in Kansas. The three-year median for 2013-2015 was 109 cases, Figure 10. Cases ranged in age from less than one year of age to 92 years. The median age was 35.5 years. The highest incidence rate (5.19 per 100,000) occurred in those 35 to 44 years of age, Figure 11. The highest number of cases were reported in July, Figure 12.

Confirmed and Probable Cases: 104

Kansas incidence per 100,000 population (2016): 3.58
U.S. incidence per 100,000 population (2015): 5.74

Figure 10 Giardiasis incidence per 100,000 population by year, 2006 – 2016



**Case definition changed*

Figure 11 Giardiasis incidence per 100,000 population, Kansas, 2016

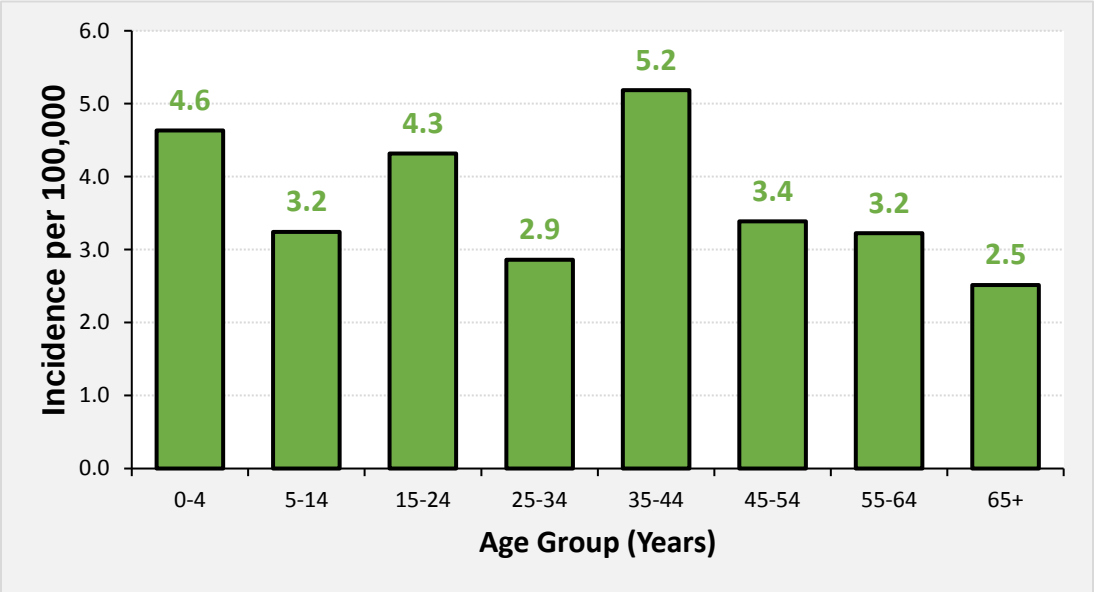
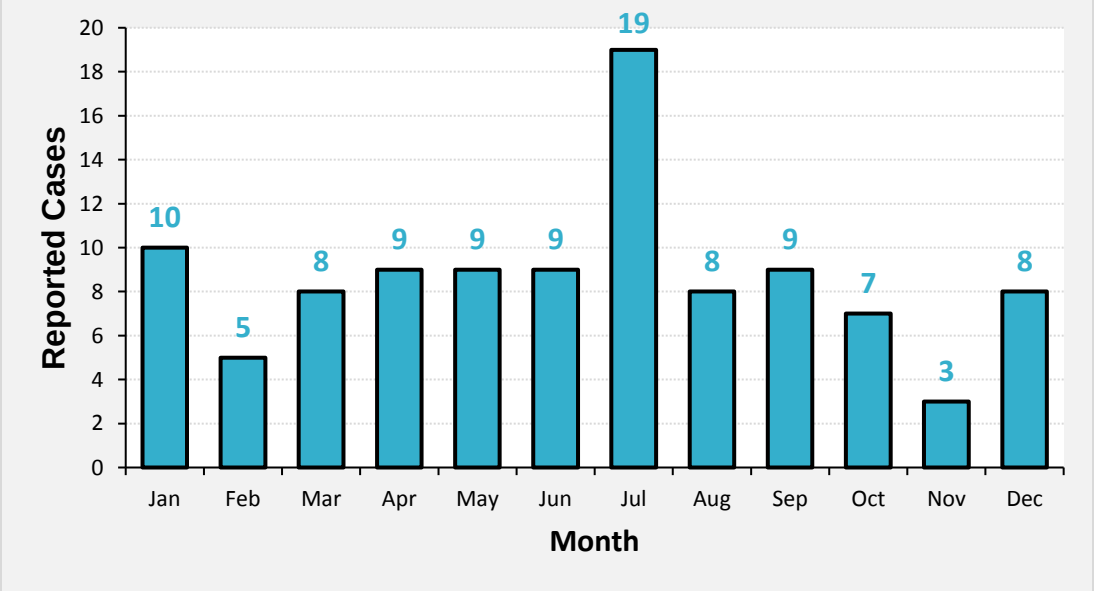


Figure 12, Giardiasis cases per month, Kansas, 2016



HAEMOPHILUS INFLUENZAE, INVASIVE DISEASE

CLINICAL FEATURES: Several clinical syndromes including meningitis, septic arthritis, epiglottitis, cellulitis, bacteremia, and pneumonia may characterize invasive infection. Symptoms of meningitis may include fever, headache, lethargy, vomiting, and stiff neck. Other symptoms depend on the part of the body affected.

CAUSATIVE AGENT: *Haemophilus influenzae*, a gram-negative bacterium with six serotypes (a through f)

MODE OF TRANSMISSION: Found in the upper respiratory tract of humans, the organism may be transmitted by direct contact or droplet inhalation of respiratory tract secretions.

INCUBATION PERIOD: Unknown; probably short, 2-4 days.

PERIOD OF COMMUNICABILITY: As long as organisms are present, which may be for a prolonged period, even without nasal discharge. Considered non-communicable within 24-48 hours after starting effective antibiotic therapy.

PUBLIC HEALTH SIGNIFICANCE: Before *H. influenzae* type B (HiB) conjugate vaccinations, *H. influenzae* type B was the leading cause of invasive diseases among children under 5 years of age. Immunization has been an effective method of limiting invasive HiB disease. Preventive antibiotics may prevent illness in close contacts to known cases of HiB, especially susceptible children.

REPORTABLE DISEASE IN KANSAS SINCE: 1997

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Invasive disease may manifest as pneumonia, bacteremia, meningitis, epiglottitis, septic arthritis, cellulitis, or purulent pericarditis; less common infections include endocarditis and osteomyelitis.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Detection of *Haemophilus influenzae* type b antigen in cerebrospinal fluid [CSF]; ***OR***
- Detection of *Haemophilus influenzae*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a validated polymerase chain reaction (PCR) assay; ***OR***
- Isolation of *Haemophilus influenzae* from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - Isolation of *Haemophilus influenzae* from a normally sterile body site (e.g., blood or CSF, or, less commonly, joint, pleural, or pericardial fluid), ***OR***
  - Detection of *Haemophilus influenzae*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., cerebrospinal fluid [CSF], blood, joint fluid, pleural fluid, pericardial fluid), using a validated polymerase chain reaction (PCR) assay

- *Probable:*
  - Meningitis with detection of *Haemophilus influenzae* type b (Hib) antigen in cerebrospinal fluid (CSF).

EPIDEMIOLOGY AND TRENDS:

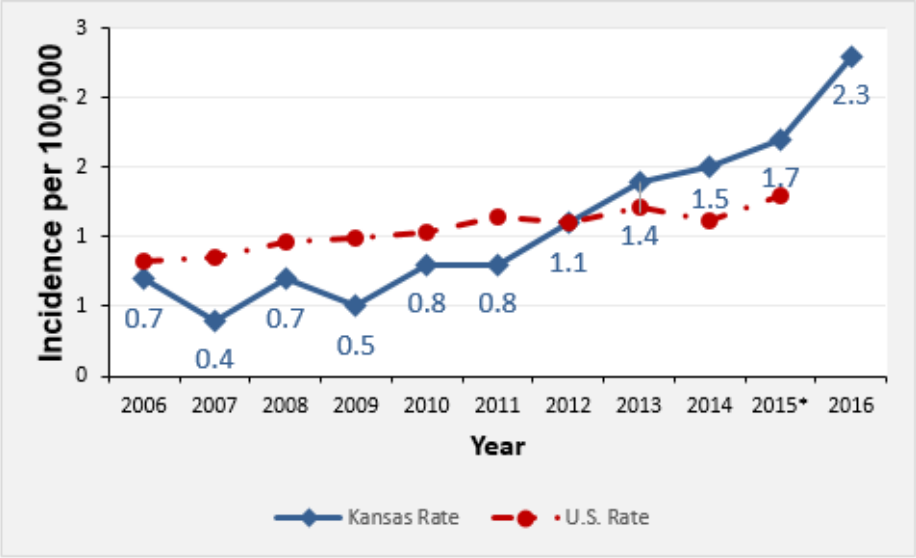
In 2016, there were 66 confirmed cases of invasive *H. influenzae* infections reported in Kansas. The three year median for 2013-2015 was 40 cases, Figure 13. Cases ranged from less than one year of age to 98 years; the median age was 70.5 years. Persons older than 65 years had the highest incidence of *H. influenzae* infections, Figure 14.

Serotyping information was available for 24 bacterial isolates. No serotype B (HiB) isolates were identified.

Confirmed and Probable Cases: 66

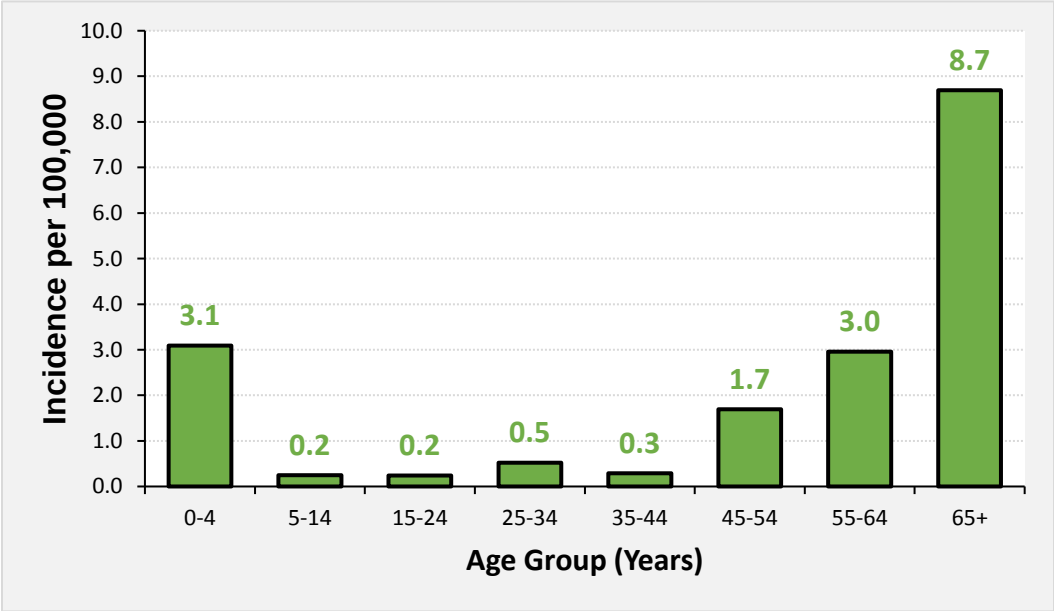
Kansas incidence per 100,000 population (2016): 2.27
U.S. incidence per 100,000 population (2015): 1.29

Figure 13 *Haemophilus influenzae* (invasive) incidence per 100,000 population by year, 2006 – 2016



**Case definition change*

Figure 14 *Haemophilus influenzae* (invasive) incidence per 100,000 population, Kansas, 2016



HEMOLYTIC UREMIC SYNDROME, POST-DIARRHEAL

CLINICAL FEATURES: Hemolytic uremic syndrome (HUS) is characterized by the acute onset of microangiopathic hemolytic anemia, renal injury, and low platelet count. Thrombotic thrombocytopenic purpura (TTP) has a similar clinical presentation but can also include central nervous system (CNS) involvement and fever. Most cases of HUS (but few cases of TTP) occur after an acute gastrointestinal illness (usually diarrheal).

Many patients with HUS require blood transfusions (about 70% of cases) or dialysis (50%); up to a quarter have neurological symptoms including stroke, seizure, or coma. Kidney function returns in up to 70% of HUS cases, but some individuals experience permanent kidney failure. HUS is fatal in about 5% of cases.

CAUSATIVE AGENT: Shiga toxin-producing bacteria, particularly Shiga toxin-producing *Escherichia coli* (STEC) including *E. coli* O157, which causes an estimated 90% of HUS cases. *Shigella dysenteriae* type 1 may also cause HUS. HUS develops in about 5% of sporadic STEC cases, but in up to 20% of infections with outbreak strains of STEC.

To reduce the likelihood of HUS development, persons with suspected STEC infection should not be treated with beta-lactam antibiotics. Evidence suggests that all antimicrobial therapy should be avoided in persons who may have STEC, particularly in those under 5 years of age.

MODE OF TRANSMISSION: HUS is not transmissible, although its causative agent may be transmitted via the fecal-oral route—susceptible individuals ingest food or liquids contaminated with human or animal feces. Outbreaks have been linked to animal contact, eating undercooked ground beef, consuming contaminated produce, and drinking contaminated water or unpasteurized juice. Person-to-person transmission may also occur, especially within daycare settings and nursing homes.

INCUBATION PERIOD: The incubation period for Shiga toxin-producing *Escherichia coli* (STEC) including *E. coli* O157 ranges from 1 to 10 days. Symptoms of HUS typically begin about a week after the onset of diarrhea, often when diarrheal illness is beginning to resolve.

PERIOD OF COMMUNICABILITY: N/A

PUBLIC HEALTH SIGNIFICANCE: HUS is most commonly caused by STEC strains that produce Shiga toxin 2. STEC infections are often associated with consumption of contaminated beef and food products. Monitoring this disease serves as a potential indicator to problems in meat, fruit, and/or vegetable processing.

REPORTABLE DISEASE IN KANSAS SINCE: 2000

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Anemia (acute onset) with microangiopathic changes (e.g., schistocytes, burr cells, or helmet cells) on peripheral blood smear, ***AND***

- Renal injury (acute onset) evidenced by either hematuria, proteinuria, or elevated creatinine level (i.e., greater than or equal to 1.0 mg/dL in a child aged less than 13 years or greater than or equal to 1.5 mg/dL in a person aged greater than or equal to 13 years, or greater than or equal to 50% increase over baseline)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - An acute illness diagnosed as HUS or TTP that both meets the laboratory criteria and began within 3 weeks after onset of an episode of acute or bloody diarrhea

- *Probable*:
  - An acute illness diagnosed as HUS or TTP that meets the laboratory criteria in a patient who does not have a clear history of acute or bloody diarrhea in preceding 3 weeks, ***OR***
  - An acute illness diagnosed as HUS or TTP, that a) has onset within 3 weeks after onset of an acute or bloody diarrhea and b) meets the laboratory criteria except that microangiopathic changes are not confirmed

EPIDEMIOLOGY AND TRENDS

In 2016, twelve confirmed and probable cases of post-diarrheal hemolytic uremic syndrome were reported in Kansas. The three-year median for 2013-2015 was five cases.

All cases were in persons under 18 years of age. All (100%) were hospitalized; one person (8%) is known to have died. Hospitalizations for surviving patients ranged in length from 8 to 41 days (median 16 days).

Eleven (92%) cases were tested for Shiga toxin-producing *E. coli*. Of these, four (36%) tested positive but were unable to be confirmed by culture, six (54%) were confirmed as STEC O157, and one (9%) was confirmed as STEC O26.

Three HUS cases were outbreak-related; two were associated with the Louisburg Cider Mill STEC O157 outbreak, and one was associated with an STEC O157 outbreak linked to pizza dough.

Confirmed and Probable Cases: 12

Kansas incidence per 100,000 population (2016): 0.41
U.S. incidence per 100,000 population (2015): 0.09

HEPATITIS A

CLINICAL FEATURES: Abrupt onset of fever, malaise, anorexia, abdominal cramps, and sometimes diarrhea. Jaundice may develop a few days after symptom onset.

CAUSATIVE AGENT: Hepatitis A virus

MODE OF TRANSMISSION: Transmission is through person-to-person, direct fecal-oral contact; consumption of food or beverages contaminated by an infectious person (indirect-fecal oral contact); or consumption of undercooked food exposed to contaminated water or feces (i.e., mollusks, lettuce, strawberries)

INCUBATION PERIOD: 15 to 50 days (average 28 to 30 days)

PERIOD OF COMMUNICABILITY: From the latter half of the incubation period to a maximum of 7 days after the onset of jaundice. This can be as long as one month.

PUBLIC HEALTH SIGNIFICANCE: Hepatitis A incidence has decreased by 95% since 1995 when the inactivated hepatitis A vaccine was licensed. It is very effective in preventing infection and is recommended for travelers to countries where hepatitis A is a common infection as well as for daycare attendees and high-risk adults and children residing in the US.

The goal of hepatitis A surveillance in Kansas is to identify cases and apply appropriate control measures. Control measures include contact identification and administration of post-exposure prophylaxis (PEP), which consists of either the hepatitis A vaccine or hepatitis A immune globulin (IG). If control measures are completed in a timely fashion, outbreaks can be prevented.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An acute illness with a discrete onset of any sign or symptom consistent with acute viral hepatitis (e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain), and either
  - Jaundice ***OR***
  - Elevated serum aminotransferase (alanine aminotransferase or aspartate aminotransferase) levels.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Immunoglobulin M (IgM) antibody to hepatitis A virus (anti-HAV) positive

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*
  - Case that meets the clinical case definition and is laboratory confirmed, ***OR***

- Case that meets the clinical case definition and occurs in a person who has an epidemiologic link with a person who has laboratory confirmed hepatitis A

➢ *Probable*
- A case with no clinical information that is IgM positive only.

EPIDEMIOLOGY AND TRENDS

Five confirmed cases of hepatitis A were reported in Kansas in 2016. The three-year median for 2013-2015 was nine cases.

Cases ranged in age from 11 to 46 years; the median age was 27 years. The majority of cases (80%) were male, 80% were white, and for the four cases where ethnicity was documented, 75% were non-Hispanic. There was one hospitalization but no deaths. No cases had documented vaccination from hepatitis A prior to disease onset.

Seven contacts were identified; four contacts had previously been vaccinated for hepatitis A, one received vaccination as post-exposure prophylaxis, and two contacts were identified after post-exposure prophylaxis would have been effective, monitored for symptoms and found to be not infected. No contacts were lost-to-follow-up. No hepatitis A outbreaks were identified in Kansas in 2016. Investigation identified that three cases (60%) had foreign travel or exposure to a foreign traveler as a risk factor.

Confirmed Cases: 5

Kansas incidence per 100,000 population (2016):	0.17
U.S. incidence per 100,000 population (2015):	0.43

HEPATITIS B

CLINICAL FEATURES: Acute hepatitis B is an acute illness characterized by anorexia, abdominal discomfort, nausea and vomiting. Jaundice is present in <10% of children and <50% of adults. A low-grade fever, rash, and joint pain may also be present. Chronic hepatitis B illness may or may not demonstrate symptoms of hepatic inflammation. Only about one third of patients have elevated aminotransferase levels, which may fluctuate with intermittent exacerbations of hepatic inflammation. Chronic cases may have no evidence of liver disease or may have a spectrum of disease ranging from chronic hepatitis to cirrhosis or liver cancer.

CAUSATIVE AGENT: Hepatitis B virus

MODE OF TRANSMISSION: Transmission occurs via percutaneous (puncture through the skin) or mucosal contact with infectious blood or body fluids (semen, saliva, vaginal fluids) including sex with an infected partner, injection drug use that involves sharing needles, syrintes, or drug-preparation equipment, birth to an infected mother, contact with blood or open sores of an infected person, needle sticks or sharp instrument exposures, and sharing items such as razors or toothbrushes with an infected person. The likelihood of transmission is greater if the *e* antigen or viral DNA is present in an individual's blood.

INCUBATION PERIOD: 45 to 180 days (average 60 to 90 days)

PERIOD OF COMMUNICABILITY: All persons who are hepatitis B surface antigen (HBsAg) positive are potentially infectious; some individuals may clear the surface antigen from their blood, while others may not.

PUBLIC HEALTH SIGNIFICANCE: According to CDC, both acute and chronic hepatitis B cases are major causes of morbidity and mortality in the US. However, transmission of hepatitis B can be interrupted by vaccination and early identification of cases and their contacts. Timely identification of susceptible contacts of hepatitis B cases allows for effective post-exposure prophylaxis. Timely post-exposure prophylaxis is highly effective in preventing hepatitis B transmission from mother to infant. For this reason, all pregnant mothers are required to be tested for hepatitis B during pregnancy.

Routine hepatitis B vaccination is recommended for all children at birth, 1-2 and 6-18 months of age or, if not previously received, unvaccinated children up to 18 years of age. Hepatitis B vaccine is also recommended for persons in the following high-risk groups; people at risk for infection by sexual exposure, people at risk for infection by percutaneous or mucosal exposure to blood, international travelers to countries with high or intermediate levels of endemic hepatitis B virus infection, people with hepatitis C virus infection, people with chronic liver disease, people with HIV infection, people who are incarcerated, and adults who receive care in sexually transmitted disease treatment facilities, HIV testing and treatment facilities, facilities providing drug-abuse treatment and prevention services, health care settings targeting services to injection drug users, correctional facilities, health care settings targeting services to men who have sex with men, chronic hemodialysis facilities and end-stage renal disease programs, and institutions and nonresidential day care facilities for developmentally disabled persons

Hepatitis D virus causes hepatitis in individuals currently infected with hepatitis B (either acute or chronic), because hepatitis D virus cannot replicate without the hepatitis B virus. Hepatitis D virus can cause short-term or long-term infection and it can cause a chronic hepatitis B infection to become a more severe disease which can result in rapid progression to fulminant hepatitis.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

ACUTE HEPATITIS B

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An acute illness with
  - Discrete onset of symptoms ***AND***
  - Jaundice or serum aminotransferase levels (ALT) >100 IU/L

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Hepatitis B surface antigen (HBsAg) positive, ***AND***
- IgM antibody to hepatitis B core antigen (IgM anti-HBc) positive (if done)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that meets the clinical case definition, is laboratory confirmed, and is not known to have chronic hepatitis B

EPIDEMIOLOGY AND TRENDS

In 2016, 21 confirmed acute cases of hepatitis B were reported in Kansas. The three-year median for 2013-2015 was 14 cases. Ninety percent of cases were either unvaccinated or vaccine status was unknown.

Cases ranged from 25 to 67 years of age; the median age was 43 years. Thirteen (62%) cases were male, 95% were white, and of the cases where ethnicity was reported, all were non-Hispanic. Sixteen (76%) cases were hospitalized, however, none died. Fourteen (67%) cases reported having jaundice, 48% reported having fatigue, 43% reported having abdominal pain, and 38% reported having dark urine. Risk factor information was available for nineteen (90%) cases. Five (24%) reported illicit drug use; of those, three (60%) reported injection drug use, of which two (67%) reported sharing needles. Other reported risk factors by <5% of cases included blood exposure, use of a finger lancet device, and multiple sex partners in the six months prior to diagnosis.

Confirmed Cases: 21

Kansas incidence per 100,000 population (2016): 0.72

U.S. incidence per 100,000 population (2015): 1.06

PERINATAL HEPATITIS B

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Perinatal hepatitis B in the newborn may range from asymptomatic to fulminant hepatitis.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Hepatitis B surface antigen (HBsAg) positive.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - HBsAg positivity in any infant aged >1-24 months who was born in the United States or in U.S. territories to an HBsAg-positive mother.

EPIDEMIOLOGY AND TRENDS

In 2016, there were no cases of perinatal hepatitis B was reported in Kansas. The three-year median for 2013-2015 was zero cases.

There were 61 children born to hepatitis B-positive women in Kansas this year, which is comparable to births in 2015. In 2016, 96% of children born to hepatitis B positive mothers received the hepatitis B vaccine and hepatitis B immunoglobulin within one day of birth. 91% of infants completed the three dose hepatitis B vaccine series within 12 months. Of those vaccinated infants, 69% followed up with a post vaccine serological test to ensure immunity had been conferred which is a 65% increase over 2015.

Confirmed Cases: 0

Kansas incidence per 100,000 population (2016): 0.00
U.S. incidence per 100,000 population (2015): 0.01

CHRONIC HEPATITIS B

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- IgM antibodies to hepatitis B core antigen (IgM anti-HBc) negative ***AND*** a positive result on one of the following tests: hepatitis B surface antigen (HBsAg), hepatitis B *e* antigen (HBeAg), or hepatitis B virus (HBV) DNA, ***OR***
- HBsAg positive, HBV DNA positive, or HBeAg positive two times at least 6 months apart (Any combination of these tests performed 6 months apart is acceptable.)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that meets either laboratory criteria for diagnosis

EPIDEMIOLOGY AND TRENDS

In 2016, 81 confirmed cases of chronic hepatitis B were reported in Kansas.[1] The three-year median for 2013-2015 was 117 cases. 90% of cases were either unvaccinated or vaccine status was unknown.

Cases ranged from 3 to 86 years of age; the median age was 40 years. Race and ethnicity information was available for 78 (96%) of the cases. Fifty-four percent of cases were Asian, 25% were white, and 17% were Black/African-American. A vast majority (93%) of cases were non-Hispanic. Forty-seven (58%) cases were male. Sixteen (17%) cases were hospitalized and three (4%) died from infection.

Risk factor information was available for 40 (49%) cases. Nine (23%) reported contact with another hepatitis B-positive person, eight (20%) reported multiple sexual partners, and two (5%) reported injection drug use.

Confirmed Cases: 81

Kansas incidence per 100,000 population (2016): 2.79
U.S. incidence per 100,000 population (2015): 5.27

[1] Chronic hepatitis B cases reported are those that were first reported to KDHE and confirmed in 2016 (e.g., the case had two positive laboratory results in 2016, 6 months apart).

HEPATITIS C

CLINICAL FEATURES: Initial infection may be asymptomatic or mild (<90% of cases); chronic infection is common (55% to 85% of cases). Approximately 70% of the chronically infected will develop chronic liver disease, cirrhosis, or hepatocellular carcinoma. Liver function tests may be elevated or normal during chronic disease.

CAUSATIVE AGENT: The hepatitis C virus is an enveloped RNA virus in the *Flavivirdae* family.

MODE OF TRANSMISSION: Primarily as a bloodborne pathogen (e.g. sharing of contaminated objects especially needles and syringes). Transmission through sexual contact may also occur, although this is rare.

INCUBATION PERIOD: The incubation period ranges from 2 weeks to 6 months, averaging 6-9 weeks. Acute hepatitis C infection will convert to a chronic carrier state within 6 months if the acute infection does not resolve. Chronic infection may persist for 10 to 20 years prior to onset of symptoms.

PERIOD OF COMMUNICABILITY: Communicability persists as long as virus is present in the body. Chronic cases are considered infectious for life. Peaks in virus concentration correlate with peaks in ALT activity.

PUBLIC HEALTH SIGNIFICANCE: Preventative measures for hepatitis C include behavior modifications that also lower risk factors for acquiring other diseases, such as HIV. While no vaccine exists for hepatitis C, vaccination against hepatitis A and B are recommended for infected individuals.

REPORTABLE DISEASE IN KANSAS SINCE: 2000

ACUTE HEPATITIS C

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An illness with discrete onset of any sign or symptom consistent with acute viral hepatitis (fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain) ***AND***
  - Jaundice ***OR***
  - Elevated serum alanine aminotransferase (ALT) level >200 IU/L while symptomatic

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- One or more of the following three criteria:
  - Antibodies to hepatitis C virus (anti-HCV) screening-test-positive, ***OR***
  - Nucleic Acid Test (NAT) for HCV RNA positive (including qualitative, quantitative or genotyping), ***OR***

- Antigen to hepatitis C virus (HCV antigen)*

*when and if a test for HCV antigen is approved by FDA and available

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - A case that meets the clinical case definition and is laboratory confirmed ***OR***
  - Documented negative laboratory tests followed within 12 months by a positive (evidence of seroconversion)

- *Probable*
  - A case that meets clinical criteria and has a positive anti-HCV antibody test, but has no reports of a positive HCV NAT or positive HCV antigen tests, ***AND***
  - Does not have test conversion within 12 months or has no report of test conversion.

EPIDEMIOLOGY AND TRENDS

Fifteen confirmed acute cases of hepatitis C were reported in Kansas in 2016. The three-year median for 2013-2015 was 20 cases. Cases ranged in age from 1 to 78 years (median: 41 years). Thirteen (87%) cases were Caucasian and non-Hispanic, and ten (67%) were male. Nine (60%) cases reported experiencing jaundice.

Risk factor information was available for thirteen (87%) cases. Of those thirteen cases, 46% reported having contact with another hepatitis C positive individual, of those, two (33%) reported that contact to be a sexual partner. Additionally, seven (54%) cases reported multiple sexual partners. Ten (77%) cases reported illicit drug use, 80% of which reported intravenous drug use; of those, five (62.5%) reported sharing needles.

Confirmed Cases: 15

Kansas incidence per 100,000 population (2016): 0.52
U.S. incidence per 100,000 population (2015): 0.81

CHRONIC HEPATITIS C

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- One or more of the following three criteria:
  - Antibodies to hepatitis C virus (anti-HCV) screening-test-positive, ***OR***
  - Nucleic Acid Test (NAT) for HCV RNA positive (including qualitative, quantitative or genotyping), ***OR***
  - Antigen to hepatitis C virus (HCV antigen)*

*when and if a test for HCV antigen is approved by FDA and available

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*
  - A case that does not meet clinical criteria or has no report of clinical criteria, ***AND***
  - Does not have seroconversion within 12 months or has no report of seroconversion, ***AND***
  - Has laboratory confirmation.

- *Probable*
  - A case that does not meet clinical criteria or has no report of clinical criteria, ***AND***
  - Does not have test conversion within 12 months or has no report of test conversion, ***AND***
  - Has a positive anti-HCV antibody test, but no report of a positive HCV NAT or positive HCV antigen test.

EPIDEMIOLOGY AND TRENDS

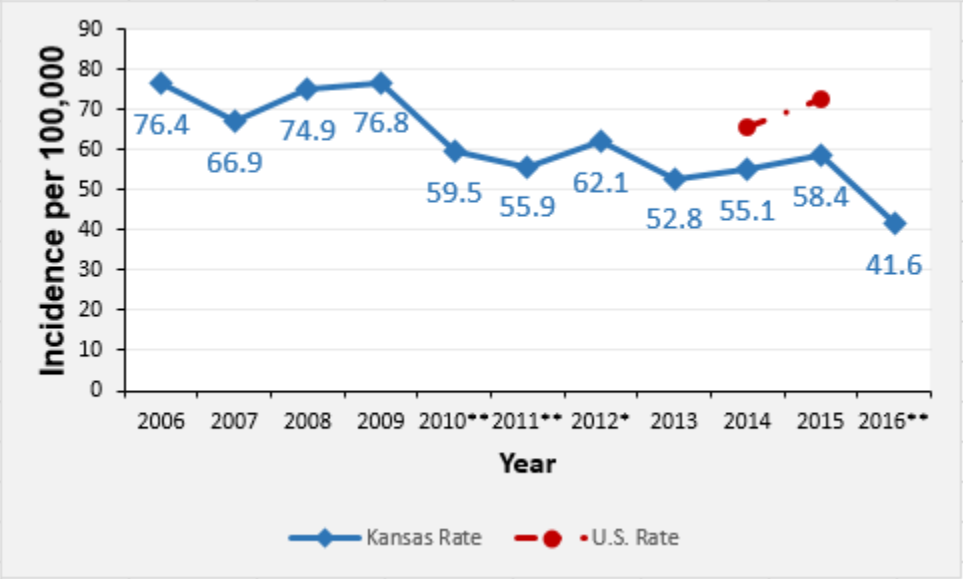
In 2016, the case definition for non-acute hepatitis C was revised resulting in the reporting of newly diagnosed chronic cases, only, with the exclusion of those 2016 cases in which there was evidence of infection clearance. In previous years, the past and present hepatitis C case counts may have included resolved infections.

There were 1,210 newly confirmed chronic hepatitis C cases reported in 2016, Figure 15. More infections were reported among males (53.0 per 100,000) than females (30.2 per 100,000). According to the race and ethnicity data that was collected, hepatitis C was most frequently reported for African-Americans (62.8 per 100,000) and non-Hispanic case-patients (34.6 per 100,000), Figures 16 and 17. Improved collection of race and ethnicity information is needed to more definitively describe the burden of chronic hepatitis C prevalence in Kansas. The median age of cases was 53 years and the highest incidence occurs in those 55-64 years of age, Figure 18.

Confirmed Cases: 1,210

Kansas incidence per 100,000 population (2016): 41.62
U.S. incidence per 100,000 population (2015): 72.64

Figure 15 Chronic hepatitis C incidence per 100,000 population by year, 2006 – 2016



*Case definition changed **Name & case definition change

Figure 16 Chronic hepatitis C incidence per 100,000 population by Race, Kansas, 2016

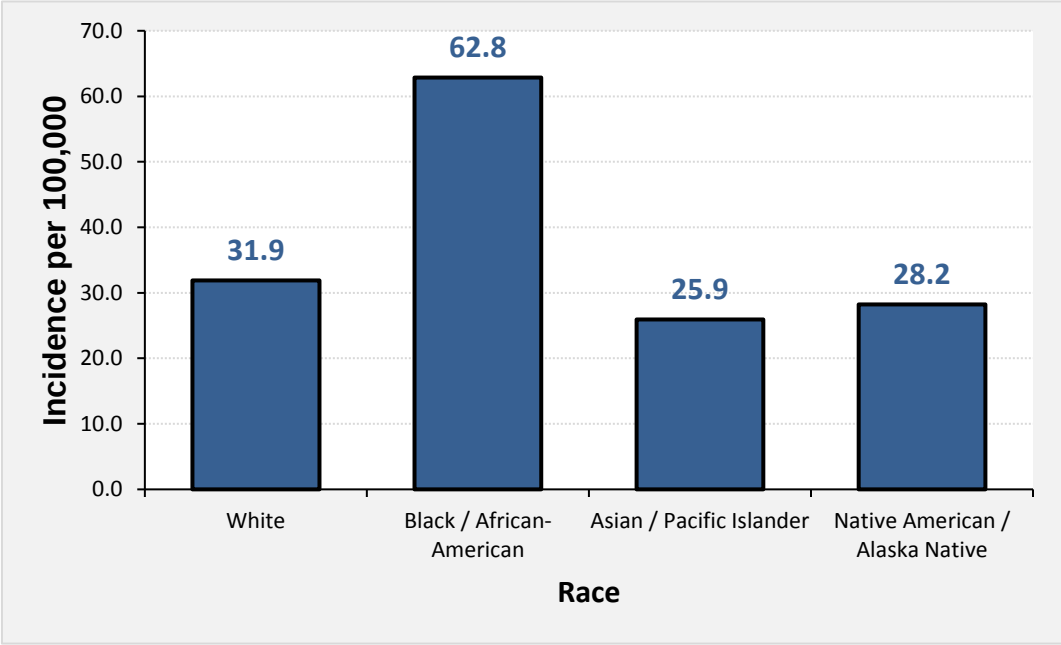


Figure 17 Chronic hepatitis C incidence per 100,000 population by Ethnicity, Kansas, 2016

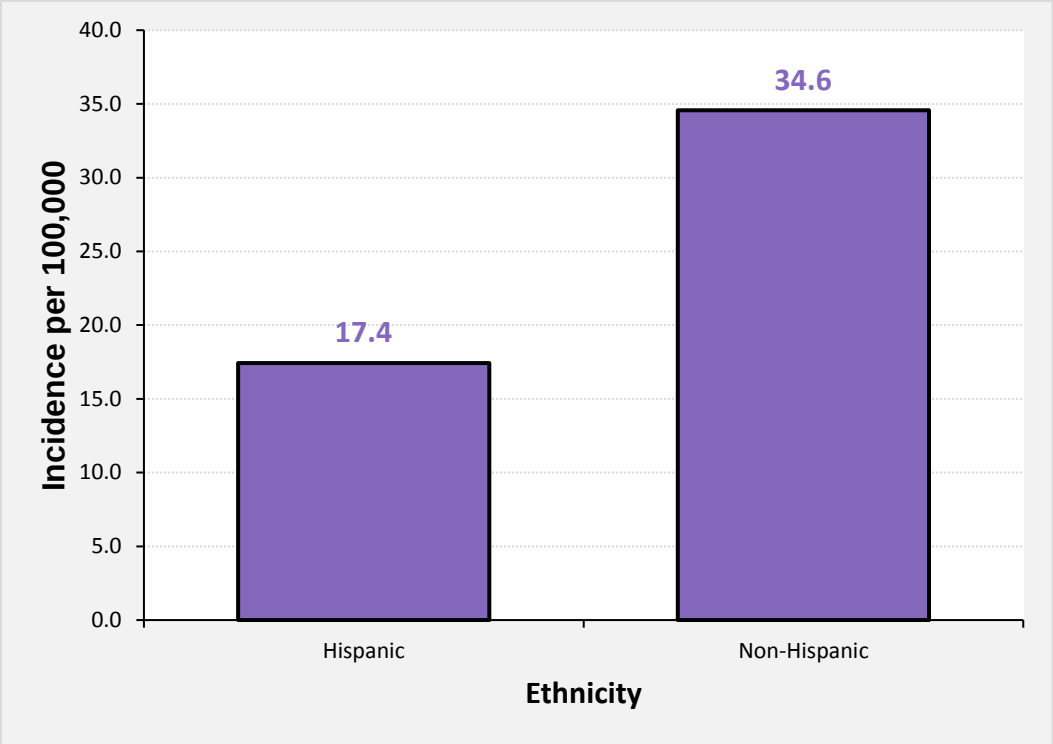
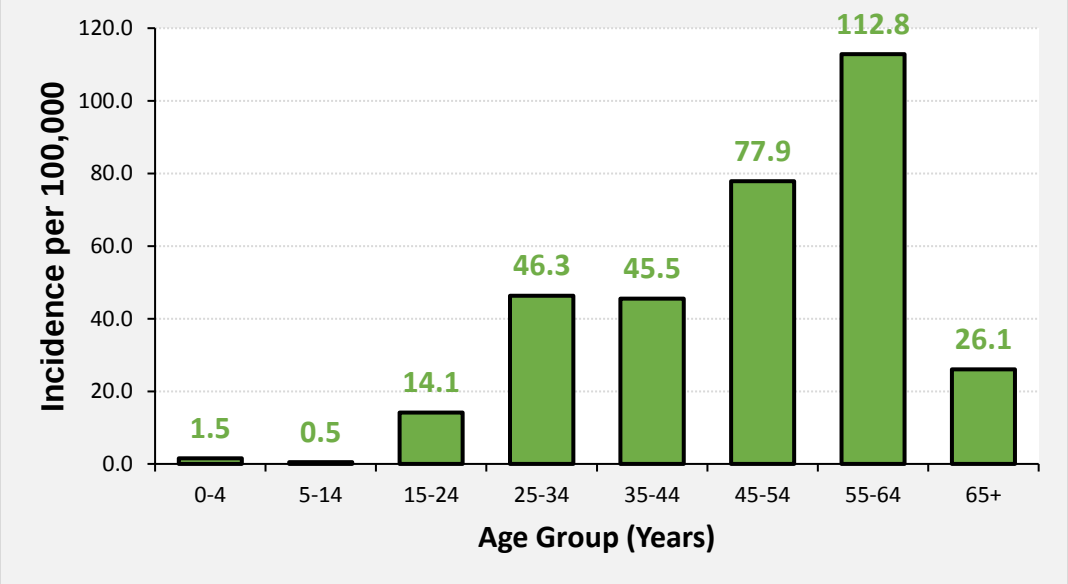


Figure 18 Chronic hepatitis C incidence per 100,000 population by age group, Kansas, 2016



LEGIONELLOSIS

CLINICAL FEATURES: Infection may result in either of two distinct illnesses: Legionnaires' disease, characterized by fever, myalgia, cough, and pneumonia; and Pontiac Fever a milder form of the illness without pneumonia.

CAUSATIVE AGENT: *Legionella spp.*, gram-negative bacilli. *L. pneumophila* serogroup 1 is most commonly associated with disease.

MODE OF TRANSMISSION: Inhalation of contaminated aerosols from a soil or water source; other modes are possible, but have not been conclusively proven.

INCUBATION PERIOD: Ranges from 2-10 days. Pontiac Fever has a shorter average incubation period (1-2 days) compared to Legionnaires' disease (5-6 days).

PERIOD OF COMMUNICABILITY: Person-to-person spread has not been documented.

PUBLIC HEALTH SIGNIFICANCE: Legionellosis is an emerging infection that most frequently occurs in the elderly and the immunocompromised. Although most illnesses are sporadic, many outbreaks have been linked to contaminated water tanks, air conditioning cooling towers, evaporative condensers, and soil at excavation sites. Public health goals are outbreak identification and environmental remediation.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - By culture: isolation of any *Legionella* organism from respiratory secretions, lung tissue, pleural fluid, or other normally sterile fluid, ***OR***
  - By detection of *Legionella pneumophila* serogroup 1 antigen in urine using validated reagents, ***OR***
  - By seroconversion: fourfold or greater rise in specific serum antibody titer to *Legionella pneumophila* serogroup 1 using validated reagents

- *Laboratory suspected*:
  - By seroconversion: fourfold or greater rise in antibody titer to specific species or serogroups of *Legionella* other than *L. pneumophila* serogroup 1 *(*e.g., *L. micdadei*, *L. pneumophila* serogroup 6) , ***OR***
  - By seroconversion: fourfold or greater rise in antibody titer to multiple species of *Legionella* using pooled antigen and validated reagents, ***OR***
  - By the detection of specific *Legionella* antigen or staining of the organism in respiratory secretions, lung tissue, or pleural fluid by direct fluorescent antibody (DFA) staining, immunohistochemstry (IHC), or other similar method, using validated reagents, ***OR***

- By detection of *Legionella* species by a validated nucleic acid assay.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A clinically compatible case that meets at least one of the confirmatory laboratory criteria.

- *Suspect*:
  - A clinically compatible case that meets at least one of the presumptive (suspect) laboratory criteria.

EPIDEMIOLOGY AND TRENDS

In 2016, 32 confirmed cases of legionellosis were reported in Kansas. The three-year median for 2013-2015 was 18 cases. Cases ranged from 24 to 85 years of age; the median age was 66 years. Older adults were more often affected, with 20 (63%) of cases occurring among individuals greater than 64 years of age; this age group had an incidence rate of 4.6 per 100,000. Twenty-four (75%) cases were male. Thirty (94%) cases were hospitalized. No deaths were reported.

Confirmed Cases: 32

Kansas incidence per 100,000 population (2016): 1.10
U.S. incidence per 100,000 population (2015): 1.89

LISTERIOSIS

CLINICAL FEATURES: Symptoms vary and are dependent on the individual affected. Neonates, elderly, immunocompromised individuals, and pregnant women are at highest risk. Symptoms include fever, malaise, headache, nausea, vomiting, meningitis, septicemia, delirium, and coma. On rare occasion, symptoms may include endocarditis, granulomatous lesions in the liver and other organs, localized internal or external abscesses, and pustular or papular cutaneous lesions. In pregnant women, infection can be transmitted to the fetus, and infants may be stillborn, born with septicemia, or develop meningitis in the neonatal period—even though the mother may be asymptomatic at delivery.

CAUSATIVE AGENT: *Listeria monocytogenes*, a gram-positive bacterium.

MODE OF TRANSMISSION: Ingestion of food or beverage contaminated with *Listeria* bacteria. High-risk foods include raw or unpasteurized milk, soft cheeses, pate, unwashed raw fruits and vegetables, and ready-to-eat meats, such as deli meat and hot dogs. Direct contact with infected materials may lead to papular lesions on hands and arms. In-utero transmission from mother to fetus may occur; transmission during passage through the infected birth canal is also possible. The principal reservoirs of *Listeria monocytogenes* are in soil, forage, water, mud, and silage. Other reservoirs include infected domestic and wild mammals, fowl, and people. Asymptomatic fecal carriage is common in humans.

INCUBATION PERIOD: Ranges from 3-70 days, with an average of 3 weeks.

PERIOD OF COMMUNICABILITY: Mothers of infected newborn infants can shed the infectious agent in vaginal discharges and urine for 7-10 days after delivery, rarely longer. However, infected individuals can shed the organisms in their stool for several months.

PUBLIC HEALTH SIGNIFICANCE: Pregnant women, fetuses and newborns infants are highly susceptible. The postpartum course of the mother is usually uneventful, but the case fatality rate is 30% in newborn infants and approaches 50% when onset occurs in the first 4 days. Severe disease in adults, including pregnant women, associated with contaminated food emphasized that older children and adults can have systemic disease with mortality. Listeriosis is often associated with contaminated food products. A product recall may be issued if *Listeria* contamination is suspected.

REPORTABLE DISEASE IN KANSAS SINCE: 2000

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of *L. monocytogenes* from a normally sterile site (e.g., blood or cerebrospinal fluid [CSF] or, less commonly, joint, pleural, or pericardial fluid), ***OR***
- In the setting of miscarriage or stillbirth, isolation of *L. monocytogenes* from placental or fetal tissues.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A clinically compatible case that is laboratory confirmed.

- *Probable:*
  - A clinically compatible case that is epidemiologically linked to a confirmed case.

EPIDEMIOLOGY AND TRENDS

Six confirmed cases of listeriosis were reported in Kansas in 2016. The three-year median for 2013-2015 was three cases. All six (100%) 2016 cases were hospitalized, no cases were pregnancy-associated, and one (17%) death was reported.

Confirmed Cases: 6

Kansas incidence per 100,000 population (2016):	0.21
U.S. incidence per 100,000 population (2015):	0.24

LYME DISEASE

CLINICAL FEATURES: A systemic, tick-borne disease, that is almost never fatal, with manifestations affecting skin, nervous system, heart and/or joints. In early stages, 60%-80% of patients present with a characteristic "bull's-eye" rash, erythema migrans (EM), accompanied by nonspecific symptoms such as fever, malaise, fatigue, headache, myalgia, and arthralgia. If untreated, some patients may develop arthritis; neurologic abnormalities, such as aseptic meningitis, facial palsy, nerve inflammation and encephalitis; and cardiac problems.

CAUSATIVE AGENT: *Borrelia burgdorferi*, a spirochete bacterium

MODE OF TRANSMISSION: Maintained in the blood and tissues of small rodents and deer, the organism is transmitted by blood to feeding ticks, specifically the *Ixode*s species including the deer tick (*I. scapularis*) and the western black-legged tick (*I. pacificus*). During its feeding process, the infected tick will transmit the organism to humans and other mammals. Transmission occurs after ≥24 hours of tick attachment.

INCUBATION PERIOD: After tick exposure, 3-32 days, with an average of 7-10 days.

PERIOD OF COMMUNICABILITY: Person-to-person transmission has not been documented.

PUBLIC HEALTH SIGNIFICANCE: A vaccine against Lyme disease was available in 2001, but has since been withdrawn by the manufacturer. The role of the health department is to provide education on the mode of tick transmission and means of personal protection.

REPORTABLE DISEASE IN KANSAS SINCE: 1990

EPIDEMIOLOGY AND TRENDS

In 2016, 39 cases of Lyme disease (16 confirmed and 23 probable) were reported in Kansas. The three-year median for 2013-2015 was 23 cases. Four (10%) case-patients were hospitalized, and no deaths were reported. Twenty-four (62%) cases were female. The median age of cases was 31 years with a range of 1 to 76 years. Among cases with known race (n=36), 34 (94%) were white, and among cases with known ethnicity (n=32), 31 (97%) were non-Hispanic.

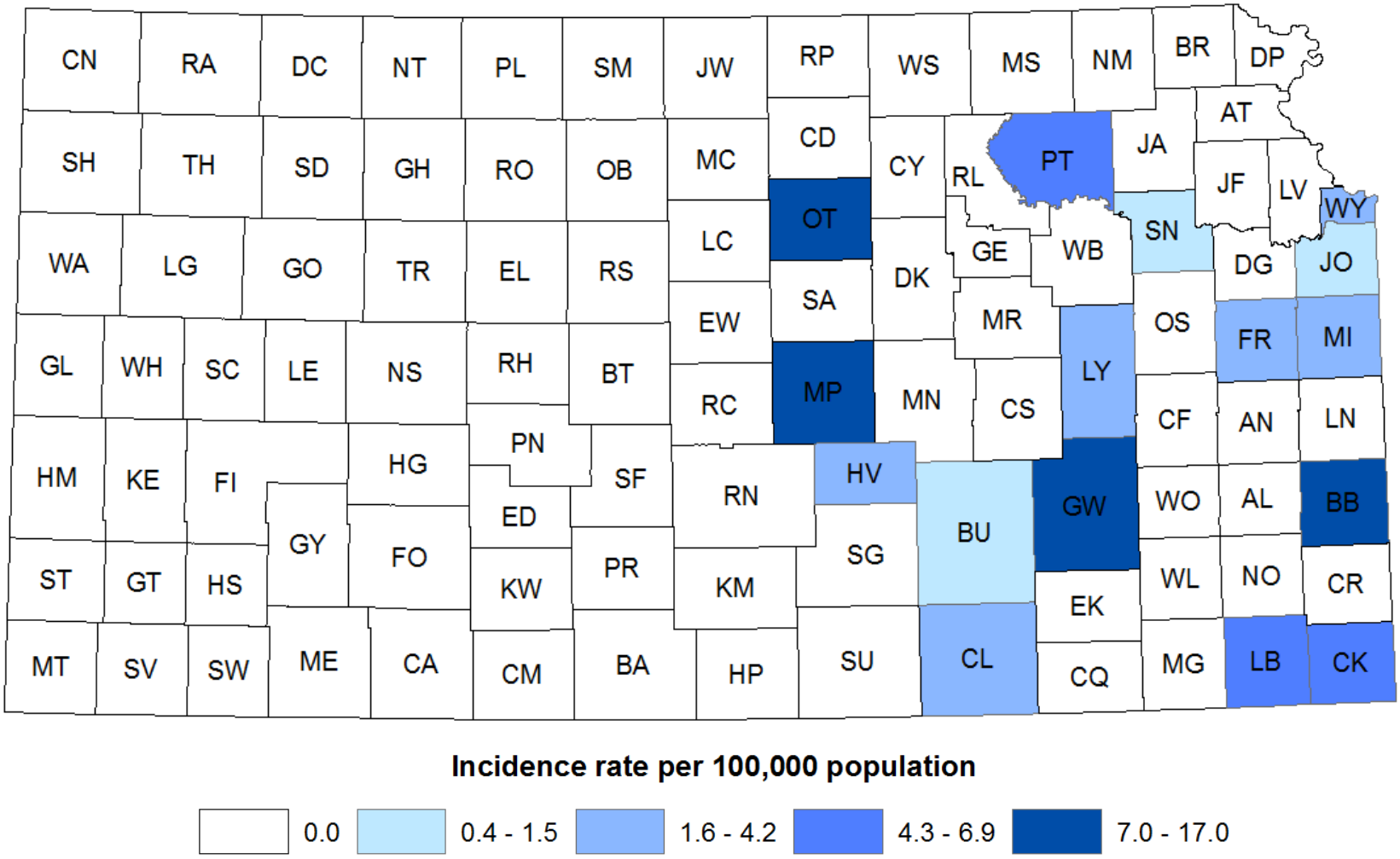
Exposure histories to determine the most likely county of tick exposure were available for all confirmed and probable cases. Eleven (69%) confirmed and 15 (65%) probable case-patients reported exposure to wooded, brushy, or grassy areas inside the state of Kansas. Two confirmed (12%) and three probable (13%) case-patients with no known tick exposures reported no travel outside of Kansas. Three confirmed (19%) and five probable (22%) case-patients were most likely exposed outside of the state of Kansas. The most likely Kansas county of exposure was identified for 29 (94%) of the 31 cases with exposure inside of Kansas. All Kansas exposures were reported in areas of the state

which correspond to the known geographic distribution of the tick vector, *Ixodes scapularis,* Figure 19.

Confirmed and Probable Cases: 39

Kansas incidence per 100,000 population (2016):	1.34
U.S. incidence per 100,000 population (2015):	11.90

Figure 19 Incidence of Lyme disease per 100,000 population by county of reported exposure*, Kansas, 2016 (n=29)



**Incidence was calculated using cases who reported tick exposure in the county and the county's population, rather than the cases' county of residence. Cases whose exposure location was unknown were excluded.*

MALARIA

CLINICAL FEATURES: The symptoms of malaria include high fever, chills, rigor, and headache, which may be recurrent. If untreated, fever and other symptoms may occur in a cyclical pattern every second or third day. Other commonly associated symptoms include back pain, sweats, myalgia, nausea, vomiting, diarrhea, and cough. Untreated *Plasmodium falciparum* infection can lead to coma, renal failure, pulmonary edema, and death. The diagnosis of malaria should be considered for any person who has these symptoms and who has traveled to an area in which malaria is endemic.

Asymptomatic parasitemia can occur among persons who have been long-term residents of areas in which malaria is endemic.

CAUSATIVE AGENT: *Plasmodium vivax, P. ovale, P. malaria,* or *P. falciparum*

MODE OF TRANSMISSION: By the bite of an infective female *Anopheles spp.* mosquito. Most species feed at dusk and during early night hours; some important vectors have biting peaks around midnight or early hours of morning. Malaria may also be transmitted by injection or transfusion of blood of infected persons or by use of contaminated needles or syringes.

INCUBATION PERIOD: The time between the infective bite and the appearance of clinical symptoms is approximately 9 to 14 days for *P. falciparum*, 12 to 18 days for *P. vivax* and *P. ovale*, and 18 to 40 days for *P. malariae.*

PERIOD OF COMMUNICABILITY: *Plasmodium* may be passed on to biting mosquitoes as long as infective gametocytes are present in human blood; this varies from one to five years depending on the parasite species and response to treatment. The mosquito remains infective for life. Transmission by transfusion may occur as long as asexual forms remain in the circulating blood, up to 40 years. Stored blood can remain infective for at least one month.

PUBLIC HEALTH SIGNIFICANCE: Although malaria is not endemic to the United States or Kansas, it remains a public health threat for several reasons: (1) most persons have no protective immunity and can develop a rapid severe disease, (2) malaria cases can transmit the parasites to local mosquitoes, which in turn can pass it onto local residents. Cases of malaria in Kansas have been reported among individuals with history of foreign travel. Persons traveling to areas at high risk for malaria can protect themselves by taking effective antimalarial drugs and following measures to prevent mosquito bites.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Detection of circulating malaria-specific antigens using rapid diagnostic test (RDT), ***OR***

- Detection of species specific parasite DNA in a sample of peripheral blood using a Polymerase Chain Reaction (PCR) test, ***OR***
- Detection of malaria parasites in thick or thin peripheral blood films.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - Detection and specific identification of malaria parasite species by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country, ***OR***
  - Detection of *Plasmodium* species by nucleic acid test in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country, OR
  - Detection of unspeciated malaria parasite by microscopy on blood films in a laboratory with appropriate expertise in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.

- *Suspect:*
  - Detection of *Plasmodium* species by rapid diagnostic antigen testing without confirmation by microscopy or nucleic acid testing in any person (symptomatic or asymptomatic) diagnosed in the United States, regardless of whether the person experienced previous episodes of malaria while outside the country.

EPIDEMIOLOGY AND TRENDS

In 2016, 11 confirmed cases of malaria were reported in Kansas. No deaths were reported; however, 10 cases were hospitalized. The cases ranged from 3 to 64 years of age, with a median age of 42 years. Seven (64%) cases were male. Six cases were infected with *Plasmodium falciparum*, one was infected *P. vivax*, one was infected with *P. malariae*, one was co-infected with *P. malariae* and *P. falciparum*, and two were not speciated.

Of the six cases, all reported travel to or from malaria-endemic regions: Africa (10), and Asia (1). Information regarding malaria chemoprophylaxis prior to travel was known for 10 cases: six did not receive chemoprophylaxis and four received chemoprophylaxis. Of the four who received chemoprophylaxis, one case missed one or more doses of their medication.

Confirmed Cases: 11

Kansas incidence per 100,000 population (2016): 0.38
U.S. incidence per 100,000 population (2015): 0.43

MENINGITIS, OTHER BACTERIAL

(non-meningococcal, non-*Haemophilus influenzae,* non-Group A *Streptococcus*, and non-*Streptococcus pneumoniae*)

CLINICAL FEATURES: May include fever, headache, stiff neck, vomiting, and rash.

CAUSATIVE AGENT: For the purposes of this document, "other" bacterial meningitis is defined as an infection of the meninges caused by bacteria other than *Neisseria meningitidis*, *Haemophilus influenza*, Group A *Streptococcus,* or *Streptococcus pneumoniae*.

MODE OF TRANSMISSION: Direct person-to-person contact, including respiratory droplets from the nose or throat of infected individuals.

INCUBATION PERIOD: Ranges from 2 to 10 days

PERIOD OF COMMUNICABILITY: Untreated patients are most infectious for 2-3 weeks after the illness onset, although transmission may occur until the bacteria are no longer found in respiratory secretions.

PUBLIC HEALTH SIGNIFICANCE: Bacterial meningitis is very serious and can result in permanent disabilities and sometimes death. It affects all age groups, but causes vary by age group. Group B *Streptococcus* is a common cause of meningitis in newborns, children, and older adults whereas *Escherichia coli* is typically only a cause in newborns, and *Listeria monocytogenes* is common in older adults.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

EPIDEMIOLOGY AND TRENDS

In 2016, there were 13 confirmed cases of bacterial meningitis reported in Kansas that were caused by bacteria other than *Neisseria meningitidis*, *Haemophilus influenza*, Group A *Streptococcus,* and *Streptococcus pneumoniae*, Table 4.

The cases ranged from 9 days to 74 years of age, with a median age of 47 years. Ten (77%) cases were male. Ten (77%) were hospitalized and two deaths were reported.

Confirmed Cases: 13

Kansas incidence per 100,000 population (2016): 0.45
U.S. incidence per 100,000 population (2015): *N/A*

Table 4 Reported bacterial meningitis by causative agent – Kansas, 2016

Number of Cases	Bacterial Causative Agent
6	*Staphylococcus aureus*
1	*Staphylococcus sciuri*
1	*Staphylococcus haemolyticus*
1	*Staphylococcus epidermidis*
1	Group C *Streptococcus*
1	Group B *Streptococcus*
1	*Escherichia coli*
1	Unknown

MENINGOCOCCAL DISEASE

CLINICAL FEATURES: The disease manifests most commonly as meningitis and/or meningococcemia that may progress rapidly to purpura fulminant, shock, and death. The disease is characterized by sudden onset with fever, intense headache, nausea (often with vomiting), and stiff neck. Up to 15% of the population may carry *N. meningitidis* in the nasopharynx without developing invasive disease, while a few develop bacteremia, sepsis, meningitis, or pneumonia. Even with early diagnosis and appropriate treatment, the fatality rate of meningococcal meningitis is 5-15%.

CAUSATIVE AGENT: Meningococcal disease is an acute bacterial disease caused by *Neisseria meningitidis*, a gram-negative, diplococcus bacterium. The most common serogroups of *N. meningitidis* in the United States are B, C, W-135, and Y.

MODE OF TRANSMISSION: Transmission of *N. meningitidis* is from person to person by direct contact with respiratory droplets from the nose and throat of infected individuals. Late winter to early spring is the peak season for infection, but infections can occur at any time of the year. Humans are the reservoir.

INCUBATION PERIOD: The incubation period is usually three or four days, but may range from two to 10 days.

PERIOD OF COMMUNICABILITY: Individuals are communicable until meningococci are no longer present in the discharges from the nose and mouth. Meningococci usually disappear from the nasopharynx within 24 hours after the institution of appropriate therapy. Penicillin will temporarily suppress the organisms, but will not eradicate them.

PUBLIC HEALTH SIGNIFICANCE: Vaccination and post-exposure prophylaxis are effective in preventing meningococcemia. Two types of vaccines are available to prevent meningococcal disease including a conjugate vaccine that was licensed in 2005 and protects against types A, C, Y, and W-135, and a protein vaccine that was licensed in 2014 that protects against type B. Chemoprophylaxis is used for close contacts of cases (e.g., household members, intimate contacts, health care personnel performing mouth-to-mouth resuscitation, day care center playmates). No chemoprophylaxis is recommended for less intimate contacts (e.g., school classmates, health care workers with minimal contact, etc.) except during an outbreak or in a child care center.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g.,. blood or cerebrospinal fluid [CSF]), using a validated polymerase chain reaction (PCR) assay; ***OR***
  - Isolation of *Neisseria meningitidis*

- From a normally sterile body site (e.g., blood or CSF, or less commonly, synovial, pleural, or pericardial fluid), ***OR***
- From purpuric lesions.

➢ *Probable:*
- Detection of *N. meningitidis* antigen
  - In formalin-fixed tissue by immunohistochemistry (IHC); ***OR***
  - In CSF by latex agglutination

➢ *Suspect:*
- Clinical purpura fulminans in the absence of a positive blood culture; ***OR***
- Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g., blood or CSF).

EPIDEMIOLOGY AND TRENDS

Five confirmed cases of meningococcal disease were reported in Kansas during 2016. The three-year median for 2013-2015 was 3 cases. No deaths were reported; all five cases were hospitalized. The cases ranged from 1 to 85 years of age, with a median age of 66 years. Four (80%) cases were female.

Three of the five *Neisseria* isolates were successfully serogrouped; two were identified as Y and one was identified as W-135, Table 5. Vaccination history against meningococcal disease was documented for all cases; none were vaccinated.

Confirmed Cases: 5

Kansas incidence per 100,000 population (2016): 0.17
U.S. incidence per 100,000 population (2015): 0.12

Table 5 Reported *Neisseria meningitidis* cases and isolates serogrouped — Kansas, 2005-2016

Year	Cases	Isolates Serogrouped	B	C	Y	W-135
2016	5	3	0	0	2	1
2015	5	4	1	1	0	2
2014	1	1	0	0	1	0
2013	3	3	0	0	2	1
2012	6	5	1	0	2	2
2011	5	4	1	0	3	0
2010	8	7	5	1	1	0
2009	13	6	1	2	3	0
2008	8	5	2	2	1	0
2007	10	7	3	0	1	1
2006	4	3	1	1	1	0
2005	11	11	6	1	4	0

PERTUSSIS (WHOOPING COUGH)

CLINICAL FEATURES: A prolonged, paroxysmal cough with characteristic inspiratory "whoop" is the primary symptom; post-tussive vomiting may also occur. Infants may present with apnea or cyanosis, while adults may present only with a chronic spasmodic cough.

CAUSATIVE AGENT: *Bordetella pertussis*, a bacillus bacterium.

MODE OF TRANSMISSION: Contact with respiratory secretions of infected persons.

INCUBATION PERIOD: Ranges from 4-21 days (average 7-10 days).

PERIOD OF COMMUNICABILITY: Most transmissible in the period before cough becomes paroxysmal. Communicability gradually decreases and becomes negligible after three weeks. Patients are considered infectious until five days after beginning treatment.

PUBLIC HEALTH SIGNIFICANCE: Pertussis affects all age groups, but the disease is most severe in infants and young children. A vaccine exists to prevent illness in this age group (i.e., children under seven years old). In addition, a booster vaccine is licensed for those ≥11 years of age (including individuals 65 years and older).

REPORTABLE DISEASE IN KANSAS SINCE: 1982

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - Acute cough illness of any duration, with isolation of *B. pertussis* from a clinical specimen; ***OR***
  - Cough illness lasting ≥2 weeks, with at least one of the following symptoms:
    - paroxysms of coughing; ***OR***
    - inspiratory "whoop"; ***OR***
    - post-tussive vomiting; ***OR***
    - apnea, with or without cyanosis (for infants aged <1 year only); ***AND***
    - polymerase chain reaction (PCR) positive for pertussis; ***OR***
  - Illness lasting ≥2 weeks, with at least one of the following symptoms:
    - paroxysms of coughing; ***OR***
    - inspiratory "whoop"; ***OR***
    - post-tussive vomiting; ***OR***
    - apnea, with or without cyanosis (for infants aged <1 year only; ***AND***
    - contact with a laboratory-confirmed case of pertussis.

- *Probable:*
  - In the absence of a more likely diagnosis, a cough illness lasting ≥2 weeks, with at least one of the following symptoms:
    - paroxysms of coughing; ***OR***
    - inspiratory "whoop"; ***OR***

- post-tussive vomiting; ***OR***
- apnea, with or without cyanosis (for infants aged <1 year only); ***AND***
- absence of laboratory confirmation; ***AND***
- no epidemiologic linkage to a laboratory-confirmed case of pertussis; ***OR***

- For infants aged <1 year only:
  - Acute cough illness of any duration, with at least one of the following symptoms:
    - paroxysms of coughing; ***OR***
    - inspiratory "whoop"; ***OR***
    - post-tussive vomiting; ***OR***
    - apnea (with or without cyanosis); ***AND***
    - PCR positive for pertussis; ***OR***
  - Acute cough illness of any duration, with at least one of the following symptoms:
    - paroxysms of coughing; ***OR***
    - inspiratory "whoop"; ***OR***
    - post-tussive vomiting; ***OR***
    - apnea (with or without cyanosis); ***AND***
    - contact with a laboratory-confirmed case of pertussis.

NOTE*: An illness meeting clinical case definition should be classified as "probable" rather than "confirmed" if it occurs in a patient who has contact with an infant aged <1 year who is PCR positive for pertussis and has ≥1 sign or symptom and cough duration <14 days.*

EPIDEMIOLOGY AND TRENDS

In 2016, 161 cases (77 confirmed and 84 probable) of pertussis were reported in Kansas. Cases ranged in age from 1 month to 77 years; the median age was 16 years. The incidence was highest (18.5 per 100,000 population) among children 0-4 years of age followed by children 5-14 years of age (10.7 per 100,000 population), Figure 21.

All persons reported a cough illness, Table 6. Duration of cough was reported by 99% (159/161) of cases and ranged from 8 to 121 days (median, 26 days).

There were 60 cases tested for pertussis by PCR and 54 (90%) were positive. Eight cases were tested by culture and 6 (75%) were positive.

Seventeen percent (27/161) of cases were completely unvaccinated against pertussis, Table 7.

Twelve cases were linked to two individual outbreaks in Leavenworth and Sedgwick counties. Incidence for each county can be seen in the map below, Figure 22.

Confirmed and Probable Cases: 161

Kansas incidence per 100,000 population (2016):	5.54
U.S. incidence per 100,000 population (2015):	6.46

Figure 20 Pertussis incidence per 100,000 population by year, 2006 – 2016

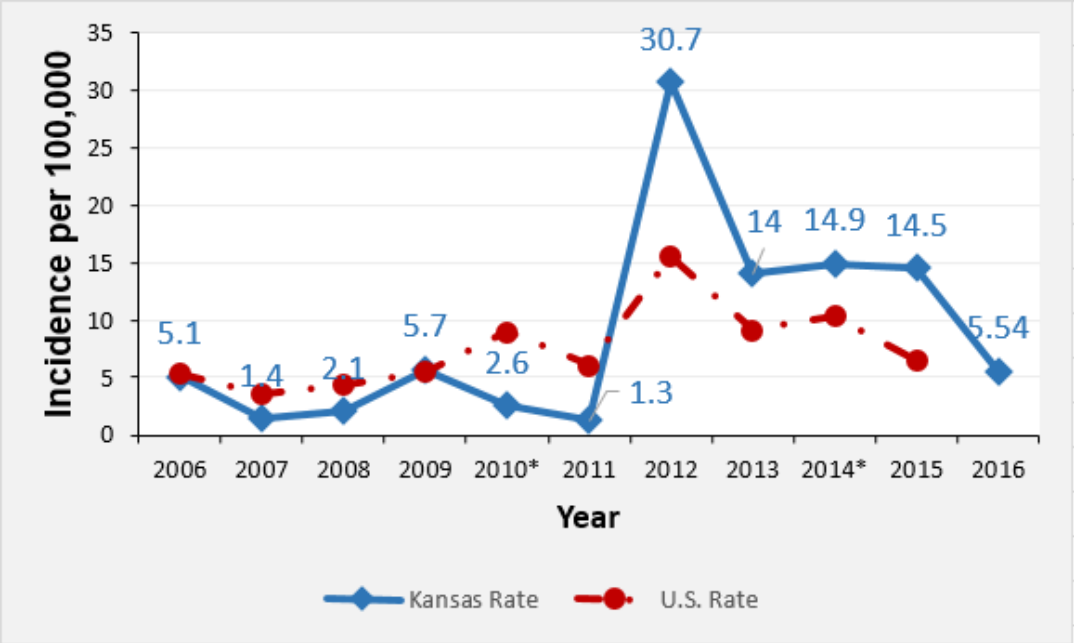


Figure 21 Pertussis incidence per 100,000 population Kansas by age group, 2016

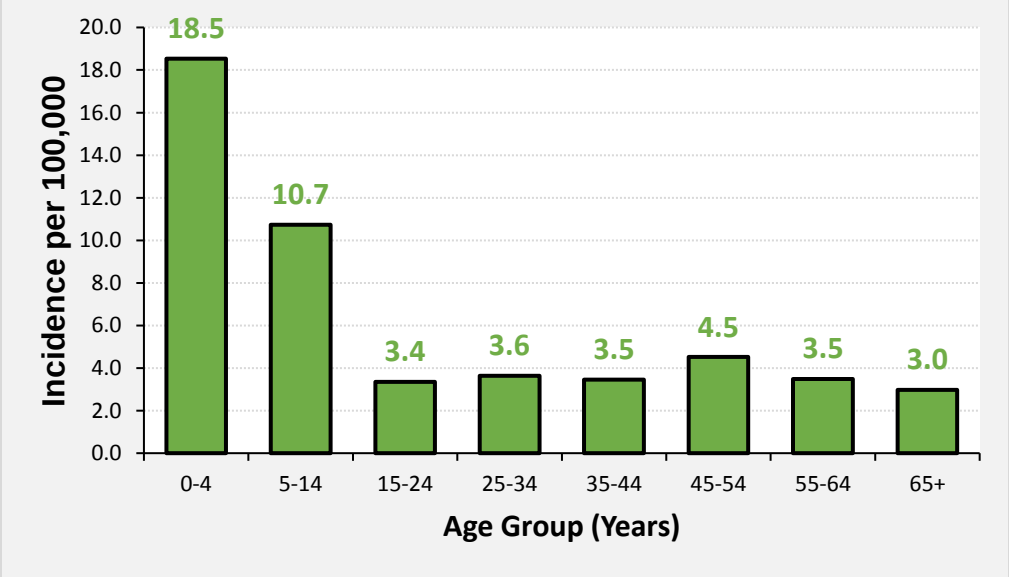


Table 6 Symptoms reported among persons with pertussis, Kansas, 2016

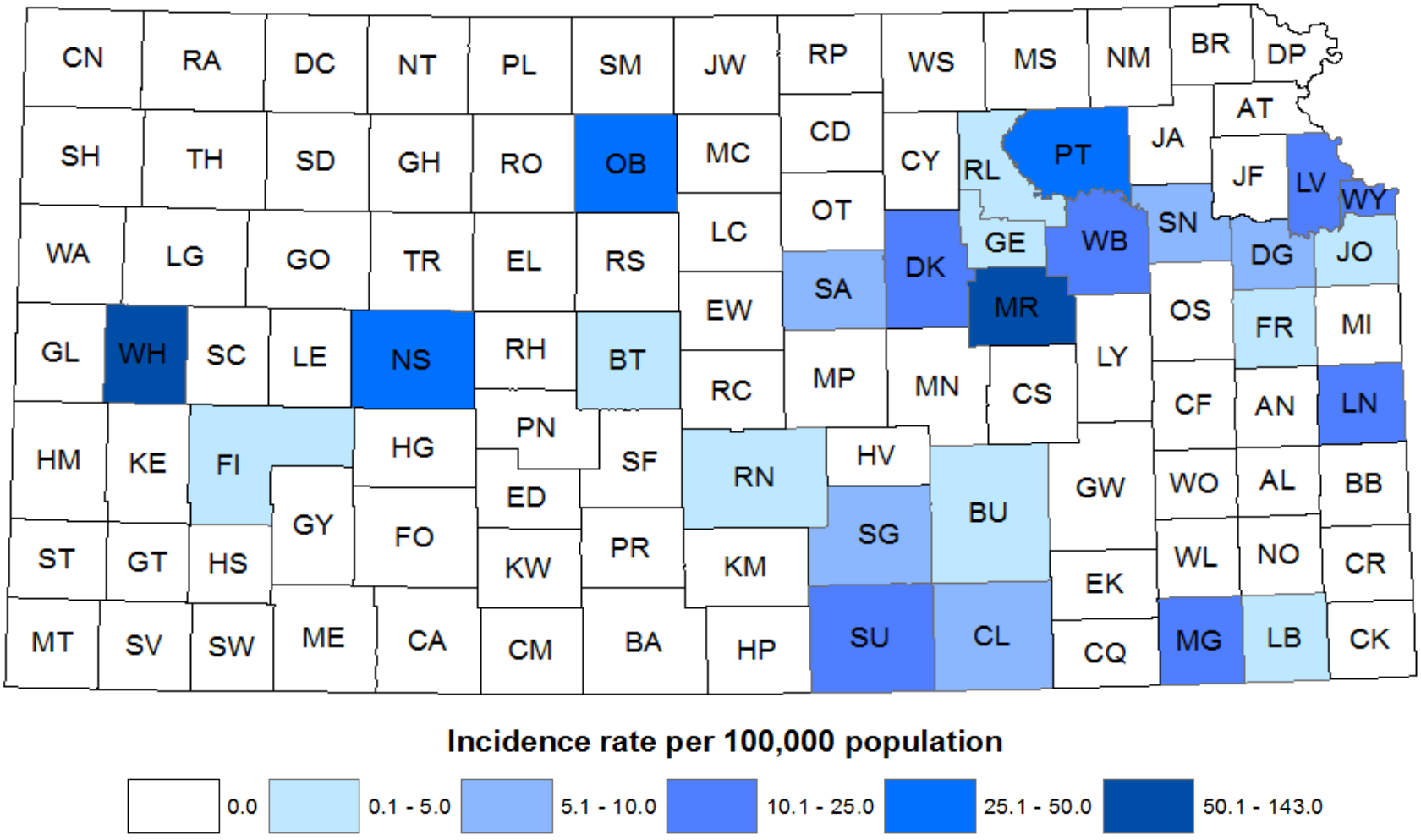
Symptom	# of Cases with Symptoms	# of Cases with Information	% of Cases with Symptoms
Cough	161	161	(100%)
Paroxysms	155	161	(96%)
Whoop	48	152	(32%)
Post-tussive vomiting	75	159	(47%)
Apnea	30	153	(20%)

Table 7 Vaccination status of persons with pertussis by age group, Kansas, 2016 (n=161)

Age Group	# of Cases	# of Unvaccinated Cases (%)
<6 months	12	5 (42%)
6 months to <1 year	1	0 (0%)
1 to 4 years	23*	9 (39%)
5 to 9 years	20	2 (10%)
10 to 14 years	23*	1 (4%)
15 to 19 years	10	1 (10%)
≥20 years	72*	9 (13%)

*37 cases had unknown vaccination status

Figure 22 Incidence of pertussis per 100,000 population by county, Kansas, 2016



Q FEVER

CLINICAL FEATURES: The onset may be sudden with chills, retrobulbar headache, weakness, malaise and severe sweats. There is considerable variation in the severity and duration of symptoms; however, acute Q fever usually lasts 1 to 4 weeks. Infections may be inapparent or present as "fever of unknown origin". A pneumonitis is found on x-ray in some cases but without the cough, chest pain, sputum production, or physical findings typical of most pneumonias. Elevated liver enzymes are common and complications can include acute and chronic granulomatous hepatitis. Chronic Q fever can manifest as endocarditis with a prolonged course lasting for years and lead to the destruction of native heart valves necessitating valve replacement. Rare clinical syndromes, including neurologic complications, have been described.

CAUSATIVE AGENT: *Coxiella burnetii*, an intracellular, rickettsial bacterium

MODE OF TRANSMISSION: The most common reservoirs are domestic farm animals, especially sheep, goats, and cows. Cats, dogs, rodents, marsupials, other mammalian species, and some wild and domestic bird species may also transmit this bacteria to humans. Tick vectors may be important for maintaining animal and bird reservoirs, but are not thought to be important in transmission to humans. Humans typically acquire infection by inhalation of *C. burnetii* in fine-particle aerosols generated from birthing fluids during animal parturition or through inhalation of dust contaminated by these materials.

INCUBATION PERIOD: Can vary from 9 to 39 days but is usually 14 to 22 days.

PERIOD OF COMMUNICABILITY: Direct transmission from person to person rarely, if ever occurs. However, contaminated clothing may be a source of infection.

PUBLIC HEALTH SIGNIFICANCE: The organism responsible for Q fever is a potential bioterrorism agent. Special safety practices are recommended for laboratory procedures and research facilities involving *Coxiella burnettii.* Strict adherence to proper hygiene when handling parturient animals can help decrease the risk of infection in the farm setting.

REPORTABLE DISEASE IN KANSAS SINCE: 2000

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

Acute Q Fever

- Acute fever ***AND*** one or more of the following: rigors, severe retrobulbar headache, acute hepatitis, pneumonia, or elevated liver enzyme levels.

Chronic Q Fever

- Newly recognized, culture-negative endocarditis, particularly in a patient with previous valvulopathy or compromised immune system, suspected infection of a vascular aneurysm or vascular prosthesis, or chronic hepatitis, osteomyelitis, osteoarthritis, or pneumonitis in the absence of other known etiology.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

Acute Q Fever

- *Laboratory confirmed:*
  - Serological evidence of a fourfold change in IgG antibody titer to *C. burnetii* phase II antigen, ***OR***
  - Detection of *C. burnetii* DNA in a clinical specimen via amplification of specific target by PCR assay, or by IFA between paired serum samples, (antibody titers to phase I antigen may be elevated or rise as well), ***OR***
  - Demonstration of *C. burnetii* in a clinical specimen by IHC, ***OR***
  - Isolation of *C. burnetii* from a clinical specimen by culture.

- *Laboratory supportive:*
  - Single supportive IFA IgG titer of ≥1:128 to phase II antigen (phase I titers may be elevated as well).
  - Serologic evidence of elevated phase II IgG or IgM antibody reactive with C. burnetii antigen by ELISA, dot-ELISA, or latex agglutination.

Chronic Q Fever

- *Laboratory confirmed:*
  - Serological evidence of IgG antibody to *C. burnetii* phase I antigen, ***OR***
  - Detection of *C. burnetii* DNA in a clinical specimen via amplification of specific target by PCR assay, or ≥ 1:800 by IFA (while phase II IgG titer will be elevated as well; phase I titer is higher than the phase II titer), ***OR***
  - Demonstration of *C. burnetii* in a clinical specimen by IHC, ***OR***
  - Isolation of *C. burnetii* from a clinical specimen by culture.

- *Laboratory supportive:*
  - An IgG antibody titer to *C. burnetii* phase I antigen ≥1:128 and <1:800 by IFA.

SURVEILLANCE CASE DEFINITIONS

Acute Q Fever

- *Confirmed:*
  - A laboratory confirmed case that either meets clinical case criteria or is epidemiologically linked to a lab confirmed case.

- *Probable:*
  - A clinically compatible case that has laboratory supportive results for past or present acute disease (antibody to Phase II antigen) but is not laboratory confirmed.

Chronic Q Fever

- *Confirmed:*
  - A clinically compatible case of chronic illness (meets clinical evidence criteria for chronic Q fever) that is laboratory confirmed for chronic infection.

- *Probable:*
  - A clinically compatible case that has laboratory supportive results for past or present chronic infection (antibody to Phase I antigen).

EPIDEMIOLOGY AND TRENDS

Four cases of Q fever (three probable, acute cases and one confirmed, chronic case) were reported in Kansas during 2016. Since 2008, zero to four cases have been reported annually. Exposures to cattle during calving, the consumption of noncommercial, unpasteurized goat and cow milk, and the involvement in outdoor occupations that were within cattle pastures were all exposures that were reported and all occurred in Kansas. No international travel was reported.

Confirmed and Probable Cases: 4

Kansas incidence per 100,000 population (2016): 0.14
U.S. incidence per 100,000 population (2015): 0.05

RABIES, ANIMAL

CLINICAL FEATURES: Rabies virus infects the central nervous system causing encephalopathy and death. This infection can cause a variety of clinical signs in animals. Often people will refer to "furious" rabies or "dumb" rabies. Animals with encephalitic, or furious, rabies are very aggressive and will often bite objects, other animals, or people. Animals with paralytic, or dumb, rabies may be timid and shy. They often reject food and water due to paralysis of the lower jaw and muscles. Signs of animal rabies include: changes in behavior, general sickness, problems swallowing, an increase in saliva (e.g. foaming at the mouth), wild animals appearing abnormally tame or sick, animals that bite at everything if excited, difficulty moving or paralysis, and death.

CAUSATIVE AGENT: Lyssavirus

MODE OF TRANSMISSION: Wild mammals are the most important source of infection for both humans and animals in the United States. Skunks are the main reservoir for rabies in Kansas and rabies is considered endemic in all Kansas counties. Transmission occurs through bite and non-bite exposures. Bite exposures occur when the skin is punctured by teeth; virus particles may reach a nerve and cause infection. A non-bite exposure occurs when an open wound, scratch, abrasion, or intact mucous membrane (e.g. inside of mouth, eyelids) is contaminated with the saliva, brain material, or cerebrospinal fluid from a rabid animal; a scratch from a rabid animal is also considered a non-bite exposure.

INCUBATION PERIOD: In animals, generally 15-50 days, but variable and in rare cases even several months or longer.

PERIOD OF COMMUNICABILITY: In dogs, cats, and ferrets, rabies is communicable 10 days before the onset of clinical signs, and throughout the illness until death. The period of communicability in other species is unknown.

PUBLIC HEALTH SIGNIFICANCE: Rabies infection in both animals and people is fatal. People that have been bitten by a known or suspected rabid animal should receive rabies post-exposure prophylaxis (PEP) as soon as possible. Investigation of confirmed animal rabies cases and unsuitable rabies specimens represents a significant burden for local health departments in Kansas. Public health officials conduct an exposure risk assessment for each human contact to provide recommendations for PEP and for each animal contact to determine the need for observation or quarantine.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Positive direct fluorescent antibody test (preferably performed on central nervous system tissue), ***OR***
- Isolation of rabies virus in cell culture or in a laboratory animal

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that is laboratory confirmed.

EPIDEMIOLOGY AND TRENDS

In Kansas, 54 laboratory-confirmed cases of rabies in animals were reported in 36 different counties during 2016, Figure 23. The three-year median for 2013-2015 was 70 cases. Confirmed cases per year may not represent an actual change in rabies prevalence, but rather a change in the number of animal-to-animal or animal-to-human exposures. In Kansas, animals are not usually tested unless an exposure has occurred.

In 2016, 5.1% of all animal submissions tested positive for rabies; the three-year median for 2013-2015 was 6.3%. Among animals that were commonly tested (i.e., cats, dogs, cows, bats, raccoons, skunks), skunks tested positive most frequently, Table 8. The number of animals submitted for testing and the number of rabies-positive animals tend to follow the cyclical pattern of the skunk population in the state.

Bats have been associated with most of the human cases in the United States. Six of the 166 bats submitted for testing in Kansas were positive for rabies during 2016; five were big brown bats (*Eptesicus fuscus*) and one was a hoary bat (*Lasiurus cinereus).*

Public health officials are required to identify all potential contacts (animal and human) of each rabid animal, which entails extensive investigation of each case. Thirty-one of 54 rabid animals had at least one animal contact; 62 animal contacts were identified. Eighteen of the 54 rabid animals had at least one human contact; 41 human contacts were identified. Of those people with reported exposure to confirmed rabid animals, 22 were recommended PEP by public health officials; however, 32 people received PEP, Table 9).

There were no human rabies cases in Kansas in 2016; the last reported human rabies case in Kansas was in 1968.

Confirmed Cases: 54

Figure 23 Number of rabies-positive animal species by county, Kansas, 2016

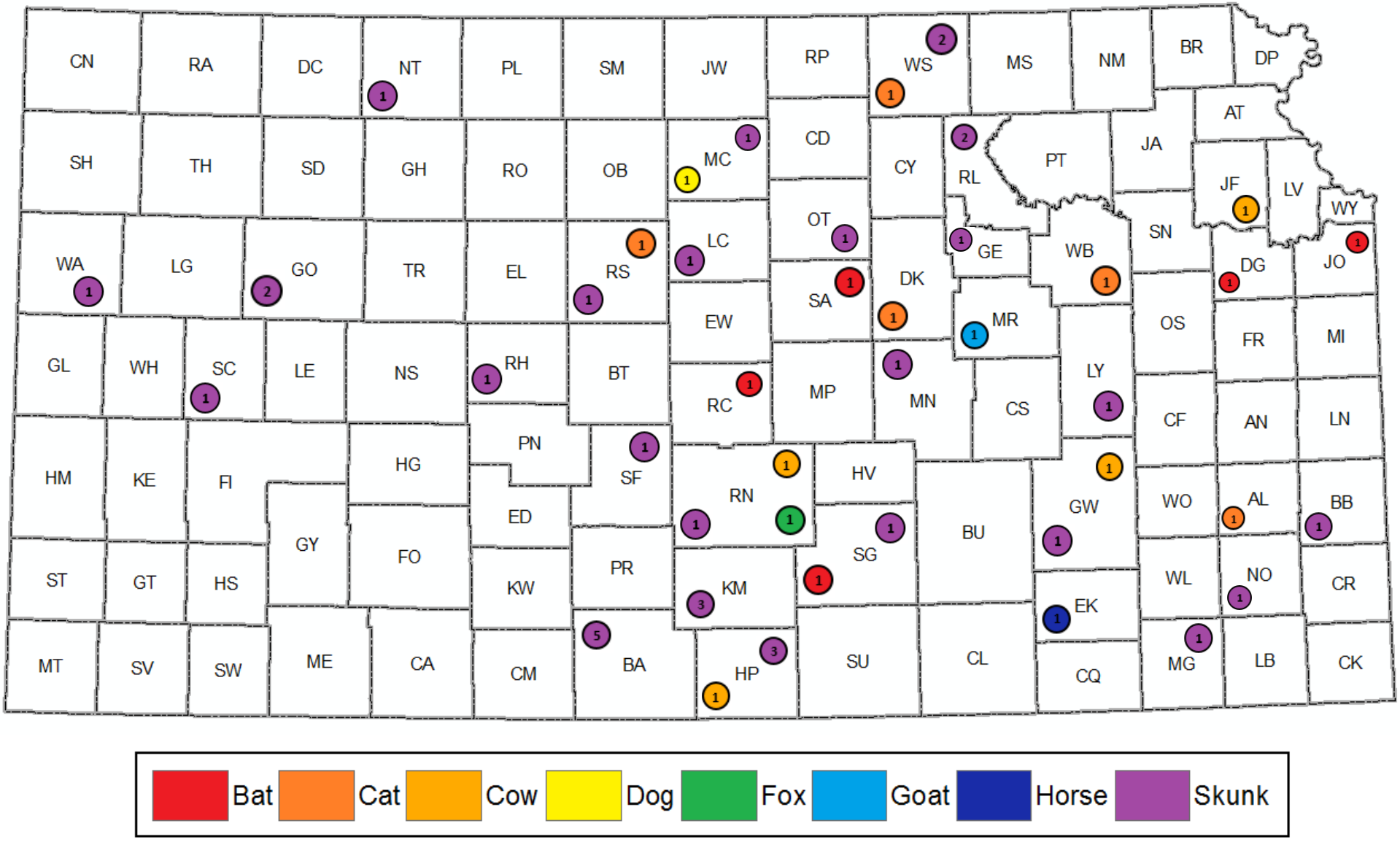


Table 8 Animal rabies testing by species, Kansas, 2016

Species		# Tested	# Positive	% Positive
Domestic	Cat	369	5	1%
	Cow	73	4	5%
	Dog	272	1	0.5%
	Donkey	1	0	0%
	Ferret	1	0	0%
	Goat	7	1	14%
	Horse	8	1	13%
	Rabbit	8	0	0%
	Sheep	4	0	0%
Wildlife	Bat	166	6	4%
	Beaver	1	0	0%
	Coyote	5	0	0%
	Fox	5	1	20%
	Mouse	4	0	0%
	Muskrat	1	0	0%
	Opossum	4	0	0%
	Prairie dog	1	0	0%
	Raccoon	55	0	0%
	Skunk	65	35	54%
	Squirrel	7	0	0%
	Woodchuck	1	0	0%

Table 9 PEP receipt of contacts to rabies-positive animals, Kansas, 2016

Species	# of Positive Cases with Human Contact	# of Contacts Recommended PEP	# of Contacts Received PEP
Bat	3	3	3
Cat	5	15	13
Cow	4	2	9
Fox	1	0	0
Goat	1	1	3
Skunk	4	1	4

SALMONELLOSIS

CLINICAL FEATURES: Acute gastroenteritis with sudden onset of fever, headache, diarrhea, abdominal pain, nausea, and sometimes vomiting. Dehydration may be severe. Asymptomatic infections and extraintestinal infections can occur, including urinary tract infections. Children younger than 4 years of age, elderly individuals, and persons with immunosuppressive conditions may experience severe complications, including invasive infection and mortality.

CAUSATIVE AGENT: *Salmonella enterica* subsp. *enterica* serovars (>2,500 serovars cause human illness), gram-negative bacteria

MODE OF TRANSMISSION: *Salmonella* bacteria live in the intestinal tracts of humans and other animals, including poultry and other birds, amphibians, and reptiles. *Salmonella* is usually transmitted to humans by eating foods contaminated with small amounts of animal feces. Contaminated foods usually look and smell normal. They are often foods of animal origin, such as beef, poultry, milk, fish, or eggs, but any food, including vegetables and fruit or processed foods, may become contaminated.

Salmonella may be found in the feces of some animals, and people can become infected if they do not wash their hands after contact with animals or animal feces. Many animals can carry *Salmonella* but appear healthy and clean. Reptiles, such as turtles, lizards, and snakes, are particularly likely to harbor *Salmonella*. Many chicks, ducks, and other poultry including those in backyard flocks can carry *Salmonella* in their feces. The area where an animal lives, such as its cage, water in its tank, or the places where an animal roams may be contaminated with *Salmonella*, which can cause illness in people who come into direct contact with the animal area, cage, or tank water.

INCUBATION PERIOD: 6-72 hours or longer, usually 12-36 hours

PERIOD OF COMMUNICABILITY: Extremely variable, usually several days to several weeks dependent upon the course of infection. A carrier state can continue for over 1 year in 1% of adults and 5% of children under 5 years of age, especially infants. Prolonged, asymptomatic fecal shedding can promote person-to-person transmission.

PUBLIC HEALTH SIGNIFICANCE: Disease can be prevented by promotion of good hand washing and food handling practices. Symptomatic food handlers should be excluded from normal duties. Outbreak situations should be examined for a common vehicle of transmission. Situations in which control cannot be established may require exclusion of infected persons from daycare, patient care, or food handling.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Isolation of *Salmonella* spp. from a clinical specimen.

- *Laboratory supportive*:
  - Detection of *Salmonella* spp. in a clinical specimen using a culture-independent diagnostic test (CIDT).

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case meets the confirmed laboratory criteria for diagnosis.

- *Probable:*
  - A case that meets the supportive laboratory criteria for diagnosis; ***OR***
  - A clinically compatible case that is epidemiologically linked to a confirmed case.

EPIDEMIOLOGY AND TRENDS

In 2016, 462 cases (453 confirmed and 9 probable) of salmonellosis were reported in Kansas. The three-year median for 2013-2015 was 467 cases. Cases ranged in age from less than 1 year to 95 years; the median age was 36 years. Though salmonellosis occurred in persons of all age groups, it was most frequently reported among those greater than 65 years of age (18% of cases). 122 cases (26%) were hospitalized and one (0.002%) death was reported. Forty-nine (11%) cases were outbreak-associated. Complete serotype information was available for 417 (92%) confirmed cases, Table 10. *Salmonella* was isolated from mostly stool specimens, but was also isolated from urine and blood, Table 11.

Confirmed and Probable Cases: 453

Kansas incidence per 100,000 population (2016): 15.89
U.S. incidence per 100,000 population (2015): 17.15

Table 10 Most common *Salmonella* serotypes, Kansas, 2016

Salmonella Serotype	*Number of Confirmed Cases*	*% of Total Confirmed Cases*
Newport	71	16%
Enteritidis	66	15%
Typhimurium	59	13%
I 4,[5],12:i:-	39	9%
Muenchen	12	3%
Thompson	12	3%
Heidelberg	11	2%
Reading	11	2%
Infantis	10	2%
Other/Unknown	162	35%

Table 11 Specimen sources for *Salmonella* isolates, Kansas, 2016

Specimen Source	*Number of Confirmed Cases*	*% of Total Confirmed Cases*
Stool	377	83%
Urine	39	9%
Blood	29	6%
Other	8	2%

SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI*

CLINICAL FEATURES: Most strains of *E. coli* are harmless and live in the intestines of healthy humans and animals; other strains may cause disease in humans. The most virulent of these strains is Shiga toxin-producing *E. coli* (STEC), formally known as enterohemorrhagic *E. coli* (EHEC). *E. coli* O157:H7 is the predominant STEC serotype. Illness due to STEC is usually self-limiting and consists of severe abdominal cramping and bloody diarrhea. Serious clinical manifestations, including hemolytic-uremic syndrome (HUS), a complication that alters normal kidney function, and postdiarrheal thrombotic thrombocytopenic purpura (TTP), a blood and kidney illness that affects the nervous system, may occur, particularly among immunocompromised individuals, young children, and the elderly.

To reduce the likelihood of HUS development, persons with suspected STEC infection should not be treated with beta-lactam antibiotics. Evidence suggests that all antimicrobial therapy should be avoided in persons who may have STEC, particularly in those under 5 years of age.

CAUSATIVE AGENT: *E. coli* consists of a diverse group of bacteria. Pathogenic (illness-causing) *E. coli* strains are categorized into pathotypes. Six pathotypes are associated with diarrhea and collectively are referred to as diarrheagenic E. coli. These include Shiga toxin-producing *E. coli* (STEC), enterotoxigenic *E. coli* (ETEC), enteropathogenic *E. coli* (EPEC), enteroaggregative *E. coli* (EAEC), enteroinvasive *E. coli* (EIEC), and diffusely adherent *E. coli* (DAEC). Only STEC is a reportable disease in Kansas.

MODE OF TRANSMISSION: Transmission of STEC occurs via the fecal-oral route, during which susceptible individuals ingest food or liquids contaminated with human or animal feces. Outbreaks of STEC infections have been linked to eating undercooked ground beef, consuming contaminated produce, and drinking contaminated water or unpasteurized juice. Person-to-person transmission can occur, especially within daycare settings and nursing homes. Zoonotic transmission of STEC can also occur, particularly from cows and goats, and outbreaks have been linked to petting zoos.

INCUBATION PERIOD: May range from 1 to 10 days, usually 3-4 days.

PERIOD OF COMMUNICABILITY: The bacteria typically disappears from the feces by the time the illness is resolved, but may be shed for several weeks, even after symptoms go away. Young children tend to carry STEC longer than adults. A few people keep shedding these bacteria and are infectious for several months.

PUBLIC HEALTH SIGNIFICANCE: Diarrhea-causing *E. coli* is often associated with contaminated beef and food products. Monitoring this disease serves as a potential indicator to problems in meat, fruit, and/or vegetable processing. A product recall may be issued if *E. coli* O157:H7 contamination is suspected—the USDA enforces a "zero tolerance" policy on this pathogen. Outbreaks associated with daycares and petting zoos are of significance due to the increased likelihood of HUS development in children infected with STEC.

REPORTABLE DISEASE IN KANSAS SINCE: 1997

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Isolation of STEC from a clinical specimen. *Escherichia coli* O157 isolates that produce the H7 antigen may be assumed to be Shiga toxin-producing. For all other *E. coli* isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC.

- *Laboratory supportive*:
  - A case with isolation of E. coli O157 from a clinical specimen, without confirmation of H antigen or Shiga toxin production
  - Identification of an elevated antibody titer to a known STEC serotype from a clinically compatible case
  - Identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of STEC

NOTE: Both asymptomatic infections and infections at sites other than the gastrointestinal tract, if laboratory confirmed, are considered confirmed cases that should be reported.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - A case that meets the laboratory criteria for diagnosis.

- *Probable*:
  - A case with isolation of *E. coli* O157 from a clinical specimen, without confirmation of H antigen or Shiga toxin production, ***OR***
  - A clinically compatible case who is a contact of an STEC case or is a member of a defined risk group during an outbreak, ***OR***
  - Identification of an elevated antibody titer to a known Shiga toxin-producing *E. coli* serotype from a clinically compatible case.

- *Suspect*:
  - A case of postdiarrheal HUS or TTP, ***OR***
  - Identification of Shiga toxin in a specimen from a clinically compatible case without the isolation of the Shiga toxin-producing *E. coli.*

EPIDEMIOLOGY AND TRENDS

In 2016, 148 cases (116 confirmed and 32 probable) of STEC were reported in Kansas. The three-year median for 2013-2015 was 97 cases. The highest rate of disease (22.64 per 100,000) was reported among children aged fewer than five years. Five (3%) of the 148 confirmed and probable STEC cases progressed to postdiarrheal hemolytic uremic syndrome (HUS). The most common STEC serotypes in Kansas in 2016 is shown in Table 12.

Thirty-seven cases of STEC were linked to an outbreak associated with attending Ciderfest at the Louisburg Cider Mill in Louisburg, Kansas in September and October, 2016.

Confirmed and Probable Cases: 148

Kansas incidence per 100,000 population (2016): 5.09
U.S. incidence per 100,000 population (2015): 2.20

Figure 12 Confirmed Shiga toxin-producing *E. coli* cases by serotype, Kansas, 2016

Serotype	Number of Cases	Percent of Cases
O157	50	43.1
O103	17	14.7
O111	17	14.7
O26	16	13.8
O145	4	3.5
O121	3	2.6
Other Serotype	9	7.6

SHIGELLOSIS

CLINICAL FEATURES: Illness of variable severity characterized by diarrhea, fever, nausea, cramps, and tenesmus. Asymptomatic infections may occur.

CAUSATIVE AGENT: *Shigella* spp., a gram-negative bacterium, including *S. flexneri, S. sonnei, S. boydii,* and *S. dysenteriae.*

MODE OF TRANSMISSION: Primarily spread through fecal-oral transmission through direct or indirect contact. May also be spread through water or milk by direct fecal contamination. Humans are the natural host for *Shigella*.

INCUBATION PERIOD: Ranges from 12 hours to 7 days (average 2 to 4 days).

PERIOD OF COMMUNICABILITY: During the acute illness until the organism is no longer present in feces. Organism will usually clear within 4 weeks of illness onset, although in rare cases it may persist for months.

PUBLIC HEALTH SIGNIFICANCE: Disease may be prevented by promotion of good hand washing. Outbreaks are common among homosexual men, in conditions of overcrowding, and in day care and institutional settings; exclusion policies may apply in some outbreak situations.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of *Shigella* spp. from a clinical specimen.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A case that is laboratory confirmed.

- *Probable:*
  - A clinically compatible case that is epidemiologically linked to a confirmed case.

EPIDEMIOLOGY AND TRENDS

In 2016, 249 confirmed and probable cases of shigellosis were reported in Kansas. The three-year median for 2013-2015 was 55 cases.

Cases ranged in age from four months to 87 years. The median age was eight years. More than one-half (55.5%) of the cases occurred among children less than 15 years of age; 6 (2%) occurred in day care settings and; the highest incidence rate occurred in those zero to five years of age (33.5 per 100,000), Figure 25.

The species of *Shigella* was reported for 185 (74%) of the 249 total cases; of these, 164 (65%) were identified as *S. sonnei* and 16 (6%) were *S. flexneri*.

Confirmed and Probable Cases: 249

Kansas incidence per 100,000 population (2016): 8.56
U.S. incidence per 100,000 population (2015): 7.34

Figure 24 Shigellosis incidence per 100,000 population by year, 2006 – 2016

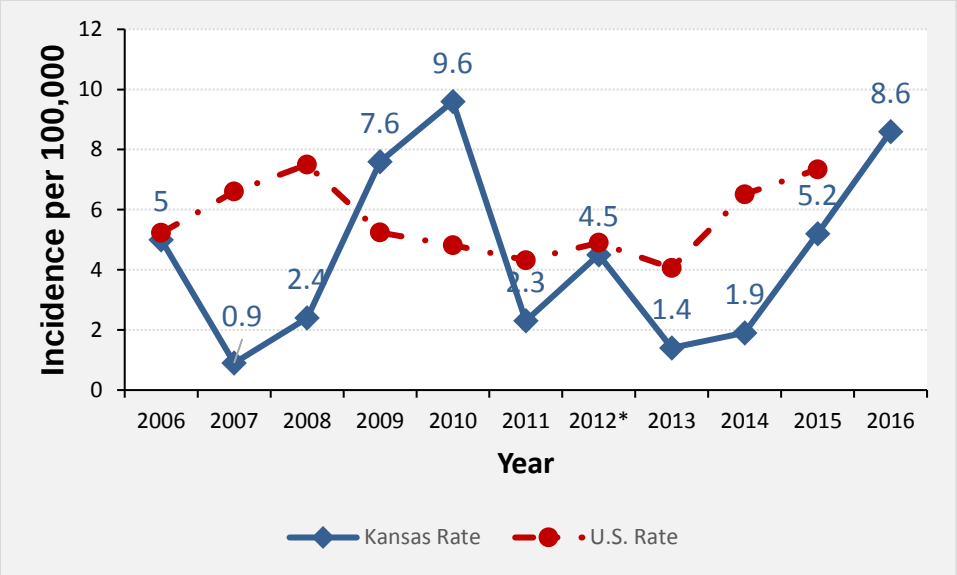
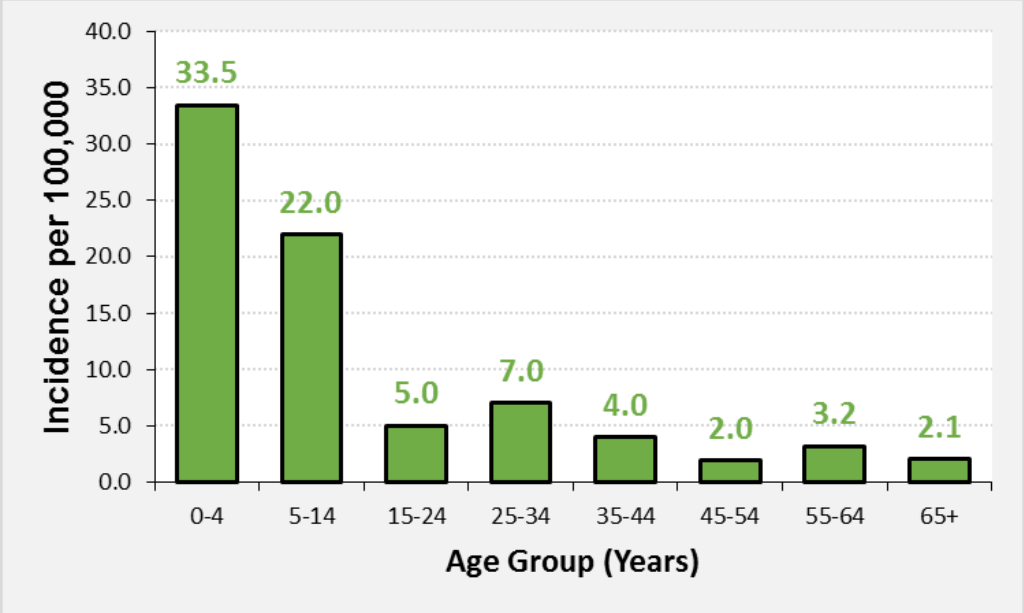


Figure 25 Shigellosis incidence per 100,000 population by age group, Kansas, 2016



SPOTTED FEVER RICKETTSIOSIS

CLINICAL FEATURES: All rickettsioses cause fever, rash, and vasculitis. In the case of Rocky Mountain spotted fever, cases initially present with sudden onset of moderate to high fever, malaise, deep muscle pain, severe headache, chills, and loss of appetite. A rash will appear 2 – 5 days after the onset of fever, and may be accompanied by abdominal pain, joint pain, and diarrhea. The characteristic rash will typically begin on the extremities, including the palms of the hands and soles of the feet, and may spread rapidly to the rest of the body

CAUSATIVE AGENT: *Rickettsia* spp. *Rickettsia rickettsii* causes Rocky Mountain spotted fever, which is maintained in nature during the complete life cycle of ticks and can be transmitted to dogs, rodents, and other animals.

MODE OF TRANSMISSION: Through the bite of an infected tick, or by contamination of broken skin by infected tick feces or blood. Typically, at least 4-6 hours of attachment is required for the *Rickettsiae* to reactivate and become infectious to humans.

INCUBATION PERIOD: From 3 days to about 14 days for Rocky Mountain spotted fever.

PERIOD OF COMMUNICABILITY: None, there is no direct transmission from person-to-person. Ticks remain infectious for their entire life, as long as 18 months.

PUBLIC HEALTH SIGNIFICANCE: Disease may be prevented through personal protective measures against ticks. No vaccine is currently licensed in the US. Case fatality rate for untreated cases is between 13% and 25%; death is uncommon in cases with prompt recognition and treatment.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Any reported fever and one or more of the following: rash, eschar, headache, myalgia, anemia, thrombocytopenia, or any hepatic transaminase elevation.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed:*
  - Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer reactive with *R. rickettsii* or other spotted fever group antigen by IFA between paired serum specimens (one taken in the first week of illness and a second 2-4 weeks later), ***OR***
  - Detection of *R. rickettsii* or other spotted fever group DNA in a clinical specimen via amplification of a specific target by PCR assay, ***OR***
  - Demonstration of spotted fever group antigen in a biopsy or autopsy specimen by IHC, ***OR***

- Isolation of *R. rickettsii* or other spotted fever group *Rickettsia* from a clinical specimen in cell culture.

➢ *Laboratory supportive:*
- Has serologic evidence of elevated IgG or immunoglobulin M (IgM) antibody reactive with R. rickettsii or other spotted fever group antigen by IFA, enzyme-linked immunosorbent assay (ELISA), dot-ELISA, or latex agglutination.

SURVEILLANCE CASE DEFINITIONS

➢ *Confirmed:*
- A clinically compatible case that is laboratory confirmed *(NOTE**:** Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Asymptomatic carriage should not be reported as typhoid fever.)*

➢ *Probable:*
- A clinically compatible case that is epidemiologically linked to a confirmed case in an outbreak

EPIDEMIOLOGY AND TRENDS

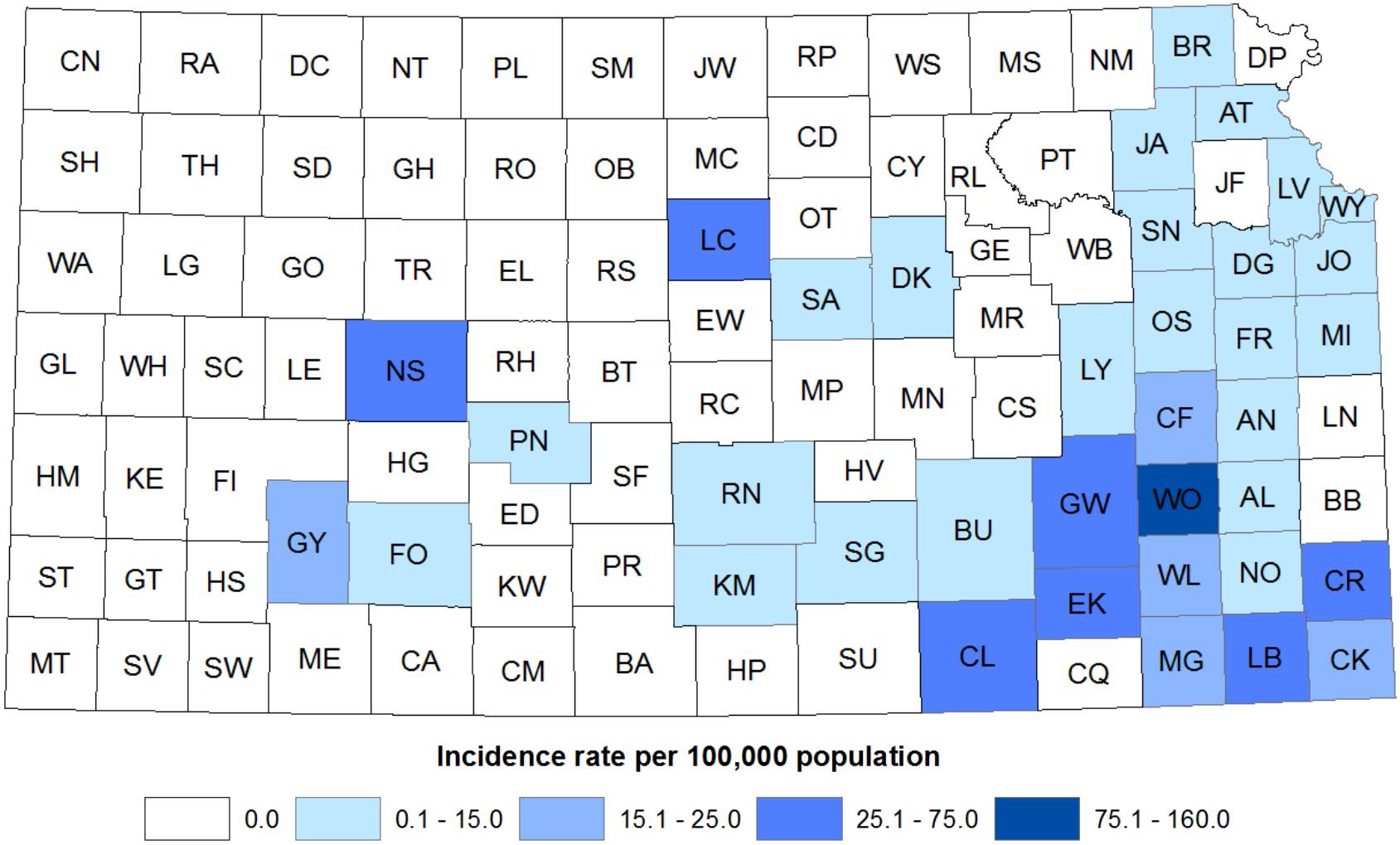
In 2016, 130 cases of spotted fever rickettsiosis were reported in Kansas; two cases were classified as confirmed, and 128 were classified as probable. Twenty-four (18%) cases were hospitalized. One death was reported. Cases ranged in age from one to 81 years, with a median age of 52 years. Eighty-nine (68%) cases were male. Among cases with known race (n=119), 118 (99%) were white, and among cases with known ethnicity (n=118), 116 were (98%) non-Hispanic.

Investigation of reported cases of spotted fever rickettsiosis includes assessment of where the case was most likely bitten by a tick. The most likely Kansas county of exposure was determined for 110 cases; 8 cases reported tick exposure outside of Kansas, and the location of tick exposure could not be determined for 12 cases. All Kansas exposures were reported in central Kansas and the eastern half of the state, Figure 26, which corresponds to the known geographic distribution of the tick vector, *Dermacentor variabilis.*

Confirmed and Probable Cases: 130

Kansas incidence per 100,000 population (2016): 4.5
U.S. incidence per 100,000 population (2015): 1.3

Figure 26: Incidence of spotted fever rickettsiosis per 100,000 population by county of reported tick exposure*, Kansas, 2016 (n=110)



**Incidence was calculated using cases who reported tick exposure in the county and the county's population, rather than the cases' county of residence. Cases whose exposure location was unknown were excluded.*

STREPTOCOCCAL INVASIVE DISEASE

Group A *Streptococcus* or *Streptococcus pneumoniae*

CLINICAL FEATURES: Symptoms vary and are dependent on the site of infection (e.g. acute otitis media, pneumonia, bacteremia, or meningitis). Group A infections are characterized by sudden onset of fever, shaking chills, pleural pain, dyspnea, tachypnea, and leukocytosis. Infants and young children may experience fever, vomiting, and convulsions.

CAUSATIVE AGENT: Group A *Streptococcus* (*Streptococcus pyogenes*) or *Streptococcus pneumoniae*

MODE OF TRANSMISSION: The organisms may spread directly via respiratory droplets and oral contact. Contact with articles (e.g. tissues) that have been freshly soiled with respiratory discharges may result in indirect transmission. Although the bacteria that cause invasive disease are commonly transmitted from person-to-person, invasive disease is not. Invasive illness among a patient's close and casual contacts is infrequent.

INCUBATION PERIOD: 14 hours to 3 days (The incubation period is not clearly defined; it may be dependent on the route of infection).

PERIOD OF COMMUNICABILITY: Untreated patients are most infectious for 2-3 weeks after the illness onset, although transmission may occur until the bacteria are no longer found in respiratory secretions. Patients are not considered infectious 24 hours after treatment has begun.

PUBLIC HEALTH SIGNIFICANCE: School and day care exclusions apply to those with streptococcal pharyngitis or skin infections. Most types of pneumococcal disease (invasive *Streptococcus pneumoniae* infections) can be prevented through vaccination.

REPORTABLE DISEASE IN KANSAS SINCE: All cases of streptococcal invasive disease have been reportable since 2000; drug-resistant strains were made reportable in 2006.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of Group A *Streptococcus* (*Streptococcus pyogenes*) or *Streptococcus pneumoniae* by culture from a normally sterile site (e.g., blood, cerebrospinal fluid, or, less commonly, joint, pleural or pericardial fluid)

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - Case that is laboratory confirmed.

EPIDEMIOLOGY AND TRENDS

In 2016, 79 cases of Group A *Streptococcus* and 235 invasive *Streptococcus pneumoniae* were reported in Kansas. The three-year median for 2013-2015 was 42 cases for Group A

Streptococcus and 149 cases for *Streptococcus pneumoniae* Figure 25 and Figure 26. Seventy-one Group A *Streptococcus* cases were hospitalized and 13 cases died. Two hundred and seven *Streptococcus pneumoniae* cases were hospitalized and 21 cases died.

The pneumococcal conjugate vaccine is recommended for children less than 2 years of age and high-risk children less than 5 years of age. In 2016, 14 of the 235 *S. pneumoniae* infections occurred among children less than 5 years of age (7.21 per 100,000 population), Figure 27. The reported national incidence for this age group in 2015 was 9 per 100,000 population. Eight of the 14 cases were not yet old enough to receive the doses of vaccine needed to be fully protected from the disease.

Pneumococcal polysaccharide vaccine is recommended for adults age 65 and older. In 2016, 96 (41%) invasive *S. pneumoniae* cases occurred among this age group, Figure 29. The pneumococcal vaccination rate among Kansans age 65 and older is 73.8%, according to the 2015 Kansas Behavioral Risk Factor Surveillance System (BRFSS).

	Group A *Streptococcus*	*Streptococcus pneumoniae*
Confirmed Cases:	**79**	**235**
Kansas incidence per 100,000 population (2016):	2.72	8.08
U.S. incidence per 100,000 population (2015):	N/A	6.93

Figure 27 Group A *Streptococcus*, invasive incidence per 100,000 population by year, 2006 – 2016*

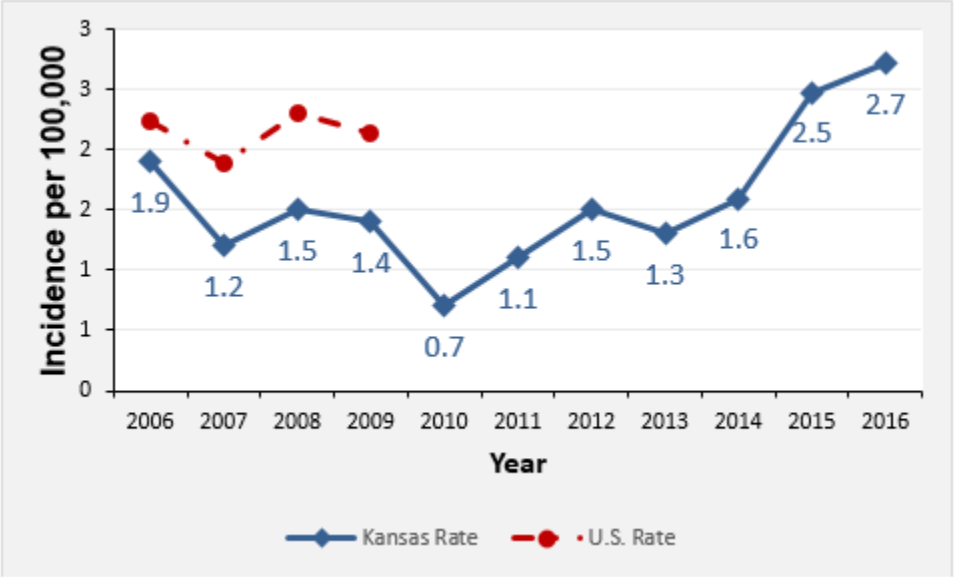
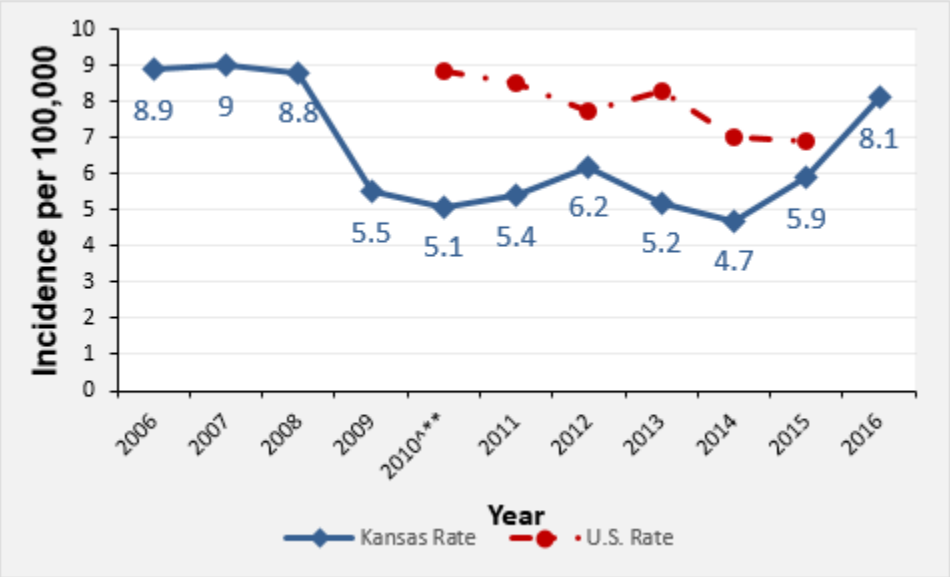
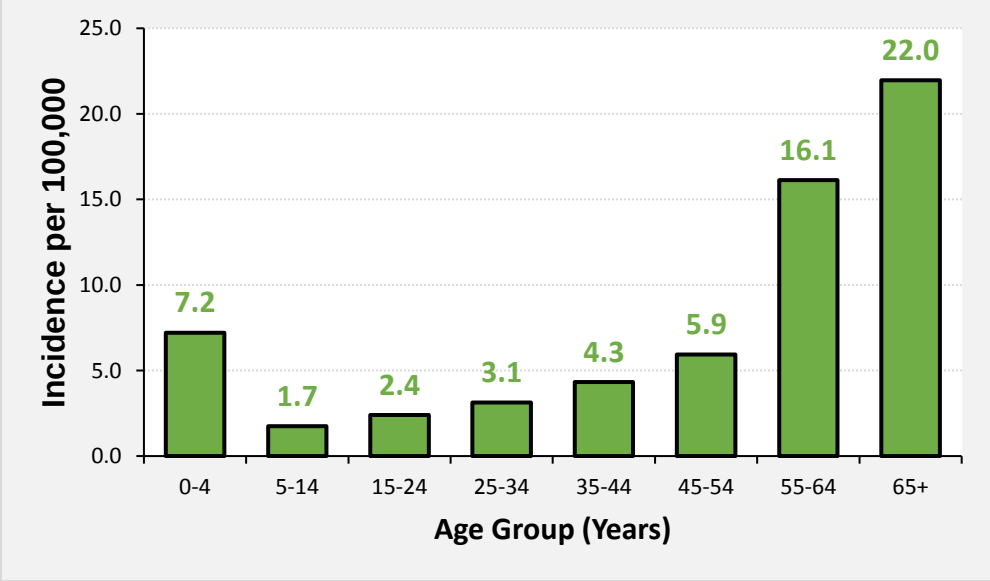


Figure 28 *S. Pneumoniae* invasive disease incidence per 100,000 population by year, 2006 – 2016*



***Name and case definition changed ^Reportable in the US*

Figure 29 *S. Pneumoniae* invasive disease incidence per 100,000 population, Kansas, 2016



TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHY (TSE)

or PRION DISEASE (including Creutzfeldt-Jakob Disease)

CLINICAL FEATURES: Prion diseases or transmissible spongiform encephalopathies (TSEs) are a family of rare progressive neurodegenerative disorders that affect both humans and animals. They are distinguished by long incubation periods, characteristic spongiform changes associated with neuronal loss, and a failure to induce inflammatory response.

CAUSATIVE AGENT: The causative agents of TSEs are believed to be prions. A prion is an abnormal, transmissible agent that is able to induce abnormal folding of normal cellular prion proteins in the brain, leading to brain damage and the characteristic signs and symptoms of the disease.

MODE OF TRANSMISSION: Most TSEs are believed to occur sporadically, due to the spontaneous transformation of normal prion proteins into abnormal proteins. However, some TSEs, such as Kuru and Variant Creutzfeldt-Jakob Disease (vCJD) have been associated with consumption of infected human or animal tissue.

INCUBATION PERIOD: Varies; TSEs have long incubation periods, measured in years.

PERIOD OF COMMUNICABILITY: Cases may be infectious for the duration of the illness, beginning early in the incubation period.

PUBLIC HEALTH SIGNIFICANCE: While most prion diseases seem to have species barriers, emphasis on disease surveillance and laboratory confirmation are needed to enhance understanding of the pathology and epidemiology of human prion diseases and to implement a system of detecting emerging human prion diseases.

REPORTABLE DISEASE IN KANSAS SINCE: 2007

EPIDEMIOLOGY AND TRENDS

In 2016, three confirmed, fatal cases of TSE were reported in Kansas. Since TSE became reportable in 2007, 1 to 5 cases have been reported annually.

Confirmed Cases: 3

Kansas incidence per 100,000 population (2016): 0.10
U.S. incidence per 100,000 population (2015): *N/A*

TULAREMIA

CLINICAL FEATURES: Most cases are characterized by acute onset of fever, chills, myalgia, and headache appearing with various clinical syndromes dependent on the route of infection. Syndromes include an ulcer at the site of inoculation with regional lymphadenopathy (ulceroglandular); regional lymphadenopathy with no ulcer (glandular); conjunctivitis with preauricular lymphadenopathy (oculoglandular); stomatitis or pharyngitis or tonsillitis with cervical lymphadenopathy (oropharyngeal); intestinal pain, vomiting and diarrhea (intestinal); febrile illness without localizing signs and symptoms (typhoidal); and primary pleuropulmonary disease (pneumonic). Cases with pneumonia can develop chest pain, difficulty breathing, bloody sputum, and respiratory failure.

CAUSATIVE AGENT: *Francisella tularensis,* a gram-negative bacterium.

MODE OF TRANSMISSION: Found in numerous wild animals, especially rabbits, hares, voles, muskrats, beavers, some domestic animals (i.e. dogs and cats), and various hard ticks. The organism is transmitted through the bite of arthropods; by inoculation of skin, conjunctiva or oropharyngeal mucosa with contaminated water, blood or tissue from infected animal carcasses; by handling or ingesting insufficiently cooked meat of infected animals; by drinking contaminated water; by inhalation of contaminated dust or aerosols; rarely, from bites of carnivores whose mouth presumably was contaminated from eating an infected animal; and from contaminated pelts and paws of animals.

INCUBATION PERIOD: The incubation period ranges from 1-14 days (usually 3-5 days).

PERIOD OF COMMUNICABILITY: Not transmitted person-to-person. Draining lesions are potentially infectious.

PUBLIC HEALTH SIGNIFICANCE: In the U.S., risk of exposure is greater for those who spend a great deal of time outdoors; incidence is higher during hunting seasons and when ticks and deer flies are abundant. Illness may be prevented through education on the following risk factors: exposure to arthropod bites, exposure to potentially contaminated water, handling sick or dead wildlife, handling wild game carcasses, and ingestion of undercooked wild game. Tularemia is a potential bioterrorism agent, particularly if distributed as an aerosol.

REPORTABLE DISEASE IN KANSAS SINCE: 1990

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- *Laboratory confirmed*:
  - Isolation of *F. tularensis* from a clinical specimen, ***OR***
  - Fourfold or greater change in serum antibody titer to *F. tularensis* antigen.

- *Laboratory presumptive*:
  - Elevated serum antibody titer(s) to *F. tularensis* antigen (without documented fourfold or greater change) in a patient with no history of tularemia vaccination, ***OR***

- Detection of *F. tularensis* in a clinical specimen by fluorescent assay.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed*:
  - A clinically compatible illness that is laboratory confirmed.

- *Probable:*
  - A clinically compatible case with laboratory results indicative of presumptive infection.

EPIDEMIOLOGY AND TRENDS

Twenty-five cases (15 confirmed and 10 probable) of tularemia were reported in Kansas during 2016. The three-year median for 2013-2015 was 28 cases. The cases ranged from 2 to 75 years of age, with a median age of 31 years. Fourteen (56%) cases were male.

Among the 2016 cases, ulceroglandular syndrome was the most common reported syndrome in 13 (52%) cases followed by glandular in seven (28%) cases, Table 12. Insect bites (i.e. tick, deerfly, unknown insect) were reported in 14 cases and five cases had contact with animals (e.g. handled deceased animal, cat bite). Eighteen hospitalizations were reported, representing 72% of the cases, but there were no deaths.

Confirmed and Probable Cases: 25

Kansas incidence per 100,000 population (2016): 0.86
U.S. incidence per 100,000 population (2015): 0.10

Table 12 Reported tularemia cases by clinical syndrome — Kansas, 2016

Tularemia Clinical Syndrome	Number of Cases (%)
Ulceroglandular	13 (52%)
Glandular	7 (28%)
Typhoidal	3 (12%)
Pneumonic	2 (8%)

TYPHOID FEVER

CLINICAL FEATURES: Insidious onset of sustained fever, marked headache, malaise, anorexia, relative bradycardia, splenomegaly, constipation or diarrhea, rose-colored spots on the trunk, and nonproductive cough. Severity of symptoms can range from mild illness to invasive disease and complications, including death. Many mild and atypical infections occur, especially in endemic areas. Carriage of *S.* Typhi may be prolonged.

CAUSATIVE AGENT: *Salmonella* Typhi bacterium (*S. enterica* serotype Typhi, formerly known as *S. typhi*).

MODE OF TRANSMISSION: Humans are the only reservoir; therefore, ingestion of food (shellfish, fruit, vegetables) and water contaminated by feces and urine of *S.* Typhi cases and asymptomatic carriers are the main sources of infection. Flies also promote spread of disease.

INCUBATION PERIOD: From 3 days to over 60 days, usual range 8-14 days.

PERIOD OF COMMUNICABILITY: Dependent upon the presence of organisms in excreta, communicability is usually from the first week throughout convalescence. Among 10% of untreated patients, this can be up to 3 months. Between 2% and 5% become permanent carriers.

PUBLIC HEALTH SIGNIFICANCE: Despite the availability of a vaccine and treatment, about 12.5 million persons in developing countries experience typhoid fever annually. A case-fatality rate of 15-20% is also observed among cases who do not receive prompt treatment. Typhoid fever infection can be prevented through access to safe water, proper sanitation, avoiding consumption of risky foods and liquids, and becoming immunized.

REPORTABLE DISEASE IN KANSAS SINCE: 1982

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- Insidious onset of sustained fever, headache, malaise, anorexia, relative bradycardia, constipation or diarrhea, and nonproductive cough.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of *S.* Typhi from blood, stool, or other clinical specimen.

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - A clinically compatible case that is laboratory confirmed *(NOTE: Isolation of the organism is required for confirmation. Serologic evidence alone is not sufficient for diagnosis. Asymptomatic carriage should not be reported as typhoid fever.)*

- *Probable:*
  - A clinically compatible case that is epidemiologically linked to a confirmed case in an outbreak

EPIDEMIOLOGY AND TRENDS

Two confirmed cases of typhoid fever was reported in Kansas during 2016. Both case-patients travelled internationally to typhoid fever endemic areas without the prior receipt of typhoid fever vaccine. Both patients were hospitalized but recovered. Since 1994, zero to four cases have been reported annually.

Confirmed Cases: 2

Kansas incidence per 100,000 population (2016):	0.07
U.S. incidence per 100,000 population (2015):	0.11

VARICELLA (CHICKENPOX)

CLINICAL FEATURES: The disease is characterized by a generalized, pruritic rash that progresses from macules to papules to vesicular lesions before crusting. Healthy, unvaccinated children normally have 200-500 lesions in 2 to 4 successive crops — the lesions are more highly concentrated on the trunk than the extremities. Rash is usually the first sign of disease in children, followed by malaise, fever, and itching. Adults may experience fever and malaise in the 1-2 days prior to rash onset; the clinical course in adults is often more severe than what is seen in children. Adults also have a higher risk of complications, including secondary bacterial infections, pneumonia, dehydration, aseptic meningitis, and encephalitis.

CAUSATIVE AGENT: Varicella zoster virus (VZV)

MODE OF TRANSMISSION: The virus is highly transmissible through direct person-to-person contact with infected respiratory tract secretions. Transmission may also occur by respiratory contact with airborne droplets or by direct contact or inhalation of aerosols from skin lesion vesicular fluid. Indirect transmission may occur if a case's vesicle fluid or respiratory secretions have soiled clothing, linens, etc.

INCUBATION PERIOD: The incubation period may range from 10 to 21 days; the average incubation period is 14 to 16 days from exposure.

PERIOD OF COMMUNICABILITY: Cases are usually infectious from 1 to 2 days before the onset of rash until all lesions are crusted. Cases with altered immunity may be infectious for a longer period of time.

PUBLIC HEALTH SIGNIFICANCE: A vaccine to protect against VZV is available; vaccination is required for school entry in Kansas. Disease has been reported in vaccinated children, although these "breakout" illnesses have been mild—with cases normally reporting fewer lesions (less than 50), no fever, and a shorter duration of illness compared to non-vaccinated individuals. School and daycare restrictions apply to infected enrollees. The vaccine is also effective as post-exposure prophylaxis in susceptible persons.

REPORTABLE DISEASE IN KANSAS SINCE: 2003

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

- An illness with acute onset of diffuse (generalized) maculo-papulovesicular rash without other apparent cause.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

- Isolation of varicella virus from a clinical specimen, ***OR***
- Varicella antigen detected by direct fluorescent antibody test (DFA), ***OR***
- Varicella-specific nucleic acid detected by polymerase chain reaction (PCR), ***OR***

- Significant rise in serum varicella immunoglobulin G (IgG) antibody level by any standard serologic assay

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*
  - An acute illness with diffuse (generalized) maculo-papulovesicular rash, ***AND***
    - Epidemiologic linkage to another probable or confirmed case, ***OR***
    - Laboratory confirmation

- *Probable:*
  - An acute illness with diffuse (generalized) maculo-papulovesicular rash, ***AND***
    - Lack of laboratory confirmation, ***AND***
    - Lack of epidemiologic linkage to another probable or confirmed case.

EPIDEMIOLOGY AND TRENDS

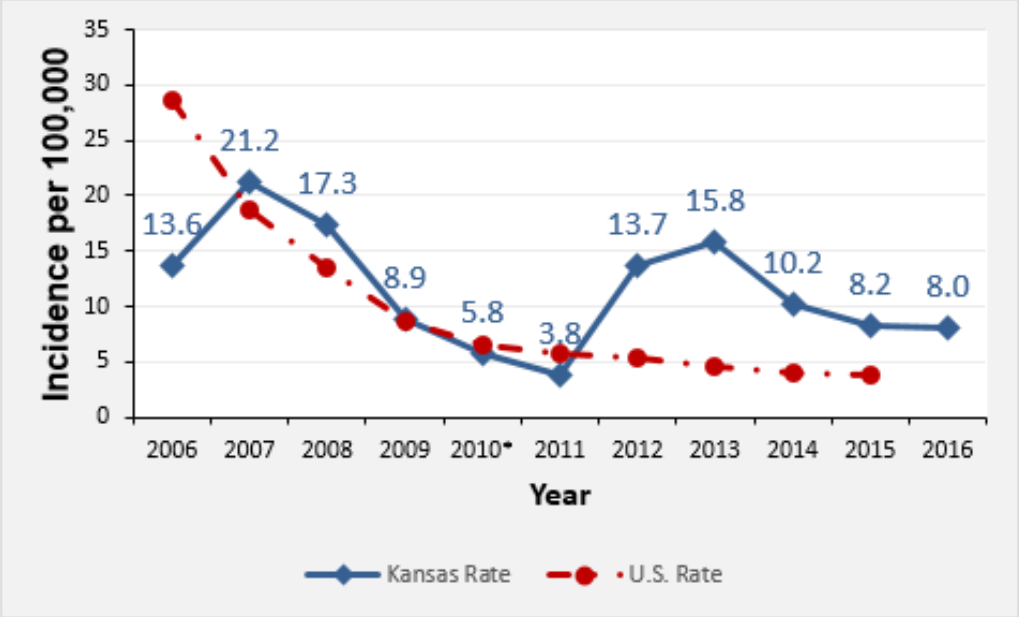
In 2016, 232 (61 confirmed and 171 probable) cases of varicella (chickenpox) were reported in Kansas. The three-year median for 2013-2015 was 395 cases. There was 1 hospitalization and no deaths in 2016. No outbreaks of varicella were reported in 2016.

Of the 232 confirmed and probable cases, transmission setting was known for 96 cases (41%). The most common transmission setting reported was "home," which accounted for 48 cases (50%); followed by school, which accounted for 18 cases (19%). The number of lesions cases was recorded for 223 cases (96%). One-hundred and one cases of the 223 varicella cases reported <50 lesions, 104 reported 50-249 lesions, 13 reported 250-500 lesions, and 5 reported >500 lesions, Figure 31. The age groups most commonly affected were those 0 to 4 years of age followed by those 5 to 14 years of age, Figure 32.

Confirmed and Probable Cases: 232

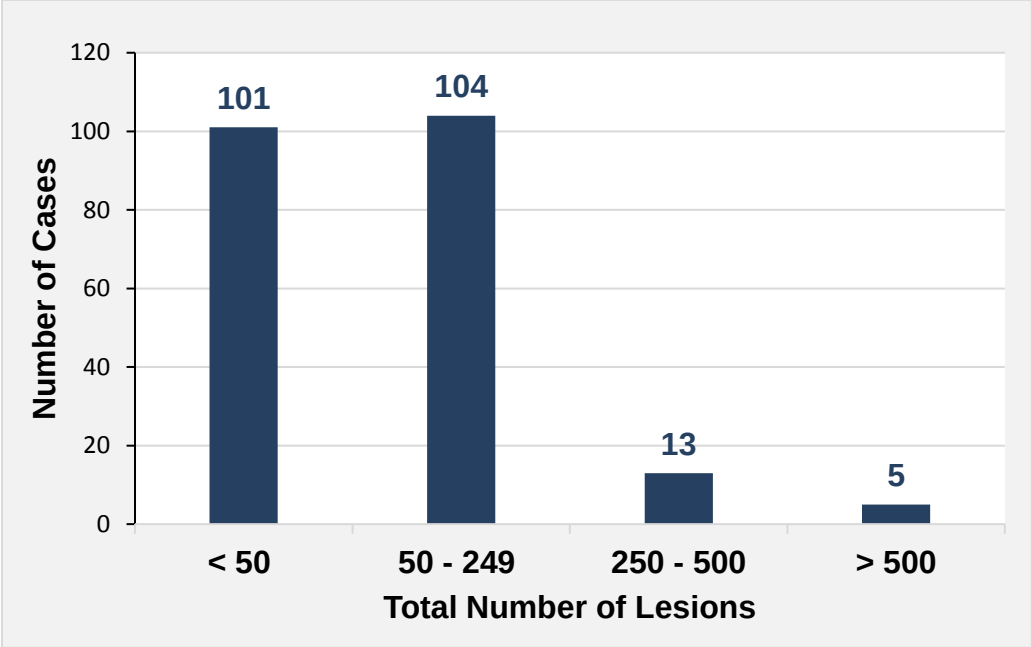
Kansas incidence per 100,000 population (2015):	8.24
U.S. incidence per 100,000 population (2013):	4.62

Figure 30 Varicella incidence per 100,000 population by year, 2006 – 2016



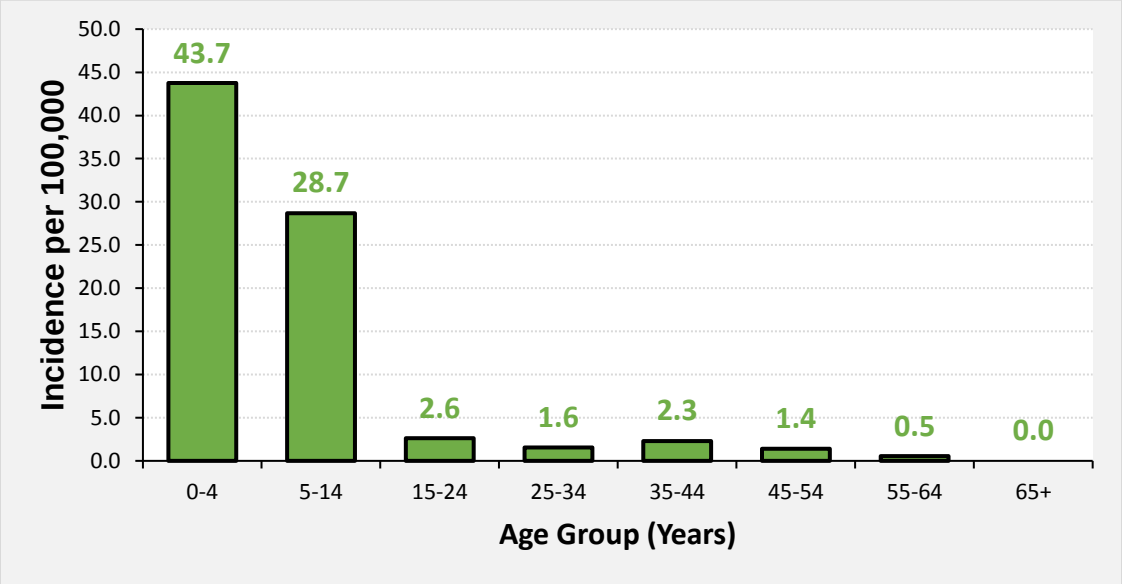
**Case definition changed*

Figure 31 Varicella cases reported by total number of lesions, Kansas, 2016 (n=232)*



**** Total number of lesions unknown for 9 cases***

Figure 32 Varicella incidence per 100,000 population by age group, Kansas, 2016



ZIKA VIRUS

CLINICAL FEATURES: Zika virus infections may result in illness that may include fever, rash, arthralgia, or conjunctivitis. Other symptoms include headache and myalgia. Many infections may be asymptomatic or the usually mild symptoms are not noticed. Symptoms may last several days to a week. Hospitalization and death are rare. Zika virus infection is also associated with Guillan-Barre syndrome, and infection during pregnancy can cause microcephaly and other severe fetal brain defects.

CAUSATIVE AGENT: Zika virus

MODE OF TRANSMISSION: Zika virus is primarily transmitted through the bite of an infected *Aedes* species mosquito. A pregnant woman can pass Zika virus to her fetus during pregnancy. Zika virus can be passed through sex from a person who has Zika to his or her partners whether they are symptomatic or not. More uncommonly, Zika virus can be transmitted through blood transfusion or exposures in laboratory or healthcare settings.

INCUBATION PERIOD: The incubation period for Zika virus is unknown but is thought to be a few to 14 days.

PERIOD OF COMMUNICABILITY: Zika virus remains in blood of an infected person for about a week or longer. It can also remain in semen longer than in blood; the specific duration is unknown.

PUBLIC HEALTH SIGNIFICANCE: The role of public health is limited to surveillance and education. Prevention is accomplished through adopting personal behaviors to prevent being bitten by mosquitoes, avoiding unprotected sexual contact when returning from an area endemic with Zika virus, and educating pregnant women to avoid travel to areas with Zika virus transmission.

REPORTABLE DISEASE IN KANSAS SINCE: Not explicitly reportable in Kansas, however, falls under the exotic or newly recognized disease clause.

CLINICAL CRITERIA FOR SURVEILLANCE PURPOSES

Zika virus disease, non-congential

- Clinically compatible illness that includes acute onset of fever, maculopapular rash, arthralgia, or conjunctivitis.
- Complication of pregnancy including fetal loss in a mother with compatible illness and/or epidemiologic risk factors; OR fetus or neonate with congenital microcephaly, congenital intracranial calcifications, other structural brain or eye abnormalities, or other congenital central nervous system-related abnormalities including defects such as clubfoot or multiple joint contractures.
- Guillain-Barre syndrome or other neurologic manifestations

Zika virus infection, non-congenital

- A person who does not meet clinical case criteria for non-congenital disease but has laboratory evidence of Zika virus infection.

Zika virus, congenital disease

- Liveborn infant with congenital microcephaly, or intracranial calcifications, or structural brain or eye abnormalities, or other congenital central nervous system-related abnormalities not explained by another etiology.

Zika virus, congenital infection

- A neonate who does not meet clinical criteria but has laboratory evidence of Zika virus infection.

LABORATORY CRITERIA FOR SURVEILLANCE PURPOSES

Recent Zika virus infection

- Culture of ZIKV from blood, body fluid, or tissue; ***OR***
- Detection of ZIKV antigen or viral RNA in serum, CSF, placenta, umbilical cord, fetal tissue, or other specimen (e.g. amniotic fluid, urine, semen, saliva); ***OR***
- Positive ZIKV IgM antibody test in serum or CSF with positive ZIKV neutralizing antibody titers and negative neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred

Recent flavivirus infection

- Positive ZIKV IgM antibody test of serum or CSF with positive neutralizing antibody titers against ZIKV and dengue virus or other flaviviruses endemic to the region; ***OR***
- Positive ZIKV IgM antibody test ***AND*** negative dengue IgM antibody test with no neutralizing antibody testing performed

SURVEILLANCE CASE DEFINITIONS

- *Confirmed:*

  Zika virus disease, non-congential

  - A case that meets the above clinical criteria for non-congenital disease and one or more the following laboratory criteria:
    - Detection of ZIKV by culture, viral antigen or viral RNA in serum, CSF, tissue, or other specimen (e.g. amniotic fluid, urine, semen, saliva); ***OR***

- Positive ZIKV IgM antibody test of serum or CSF with positive ZIKV neutralizing antibody titers and negative antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred

Zika virus infection, non-congenital

- A case that does not meet the above clinical criteria for non-congenital disease and one or more the following laboratory criteria:
  - Detection of ZIKV by culture, viral antigen or viral RNA in serum, CSF, tissue, or other specimen (e.g. amniotic fluid, urine, semen, or saliva); ***OR***
  - Positive ZIKV IgM antibody test or serum or CSF with positive ZIKV neutralizing antibody titers and negative neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred

Zika virus disease, congenital

- A neonate that meets the above clinical criteria for congenital disease and one or more the following laboratory criteria:
  - Detection of ZIKV by culture, viral antigen or viral RNA in fetal tissue, umbilical cord blood, or amniotic fluid; ***OR*** neonatal serum, urine, or CSF collected within 2 days of birth; ***OR***
  - Positive ZIKV IgM antibody test of umbilical cord blood, neonatal serum or CSF collected within 2 days of birth with positive ZIKV neutralizing antibody titers and negative neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred

Zika virus infection, congenital

- A neonate who does not meet the above clinical criteria for congenital disease and one or more the following laboratory criteria:
  - Detection of ZIKV by culture, viral antigen or viral RNA in fetal tissue, umbilical cord blood, or amniotic fluid; ***OR*** neonatal serum, urine, or CSF collected within 2 days of birth; ***OR***
  - Positive ZIKV IgM antibody test of umbilical cord blood, neonatal serum or CSF collected within 2 days of birth with positive ZIKV neutralizing antibody titers and negative neutralizing antibody titers against dengue or other flaviviruses endemic to the region where exposure occurred

➢ *Probable:*

Zika virus disease, non-congential

- A case that meets the above clinical criteria for non-congenital disease, has an epidemiologic link, and has laboratory evidence of recent ZIKV or flavivirus infection by:
  - Positive ZIKV IgM antibody test or serum or CSF with:

        - Positive ZIKV neutralizing antibody titers and dengue or other flaviviruses endemic to the region where exposure occurred; ***OR***
        - Negative dengue virus IgM antibody test and no neutralizing antibody testing performed

Zika virus infection, non-congenital

- A case that does not meet the above clinical criteria for non-congenital disease, has an epidemiologic link, and has laboratory evidence of recent ZIKV or flavivirus infection by:
    - Positive ZIKV IgM antibody test or serum or CSF with:
        - Positive ZIKV neutralizing antibody titers and dengue or other flaviviruses endemic to the region where exposure occurred; ***OR***
        - Negative dengue virus IgM antibody test and no neutralizing antibody testing performed

Zika virus disease, congenital

- A neonate that meets the above clinical criteria for congenital disease and the neonate's mother has epidemiologic linkage or meets laboratory criteria for recent ZIKV or flavivirus infection by:
    - Positive ZIKV IgM antibody test or serum or CSF collected within 2 days of birth with:
        - Positive ZIKV neutralizing antibody titers and dengue or other flaviviruses endemic to the region where exposure occurred; ***OR***
        - Negative dengue virus IgM antibody test and no neutralizing antibody testing performed

Zika virus infection, congenital

- A neonate who does not meet the above clinical criteria for congenital disease and the neonate's mother has epidemiologic linkage or meets laboratory criteria for recent ZIKV or flavivirus infection by:
    - Positive ZIKV IgM antibody test or serum or CSF collected within 2 days of birth with:
        - Positive ZIKV neutralizing antibody titers and dengue or other flaviviruses endemic to the region where exposure occurred; ***OR***
        - Negative dengue virus IgM antibody test and no neutralizing antibody testing performed

EPIDEMIOLOGY AND TRENDS

In 2016, there were 17 confirmed and 3 probable cases of Zika virus disease, non-congenital. The median age was 42 years (range 16 – 58 years). No cases were hospitalized or died. No identified cases were pregnant and all were travel-associated.

Confirmed and Probable Cases: 20

Kansas incidence per 100,000 population (2016):	0.68
U.S. incidence per 100,000 population (2015):	N/A

SECTION II: SPECIAL SURVEILLANCE PROJECTS

KANSAS INFLUENZA SURVEILLANCE SUMMARY 2016-2017

INTRODUCTION

Influenza is not a reportable disease in Kansas or nationally; therefore, non-traditional surveillance methods are utilized to track the burden of disease in the absence of patient-level data. In Kansas, six components provide data for influenza surveillance; morbidity from the influenza-like illness surveillance network, laboratory surveillance, syndromic surveillance, pneumonia and influenza mortality, influenza-associated pediatric mortality, and influenza outbreaks.

MORBIDITY SURVEILLANCE FROM THE U.S. OUTPATIENT INFLUENZA-LIKE ILLNESS SURVEILLANCE NETWORK (ILINET)

ILINet is a collaboration between multiple entities established to track influenza-like illness (ILI), recognize trends in influenza transmission, identify the types of influenza circulating, and detect changes in influenza viruses.

The Bureau of Epidemiology and Public Health Informatics (BEPHI) at KDHE recruited Kansas healthcare providers to participate in ILINet. Weekly, ILINet participants determined the total number of patients seen with ILI by age group, in addition to the total number of patients seen for any illness.

At the start of the 2016-2017 surveillance period, 35 health care providers were enrolled in ILINet. Sites observed 215,988 patients, 6,652 (3.1%) of which sought care for ILI. The ILI rate peaked in February, with 10.4% of visits attributable to ILI care.

LABORATORY SURVEILLANCE

The Kansas Health and Environmental Laboratories (KHEL) provided confirmatory testing for ILINet site patients. In addition, KHEL partnered with a Kansas hospital, which submitted influenza-positive specimens to KHEL for confirmatory testing. Real-time polymerase chain reaction (PCR) tests were used to analyze nasal and nasopharyngeal swabs for the presence of influenza virus. KHEL sent laboratory data weekly to CDC, in addition to forwarding a subset of specimens for additional testing.

During the surveillance period, KHEL tested 222 unscreened specimens for influenza; influenza was detected in 69 (31%) of the specimens. Two influenza A subtypes, A/H3 and A/H1, and two influenza B lineages, Yamagata and Victoria, were seen. Influenza A/H3 was most frequently detected, representing 81% of all previously unscreened, positive specimens. Of the 64 prescreened influenza-positive specimens received from a sentinel hospital in Kansas, 62 (97%) were A/H3. KHEL forwarded 25 influenza-positive specimens to CDC. A majority of the isolates submitted nationwide detected viruses that were similar to the components of the 2016-2017 Northern Hemisphere vaccines.

Respiratory Viral Panel Testing

In order to better understand other respiratory viruses circulating during influenza season, a subset of influenza-negative specimens were tested using the BioFire FilmArray Respiratory Panel. One hundred seventy-three total specimens were tested; 134 (83%) were negative for all viral targets. Rhinovirus/enterovirus was the most common virus found (n=13).

During the 2016-2017 season, Via Christi Laboratories in Sedgwick County shared its RVP data with KDHE monthly. The most common virus found was coronavirus, which increased with influenza activity.

Syndromic Surveillance

KDHE's Vital and Health Statistics Data Analysis section participates in the National Syndromic Surveillance Program and receives de-identified records from emergency departments (EDs) across Kansas. ED records were queried by diagnosis codes related to ILI, and ILI diagnosis codes were calculated as a percentage of total visits received each month. The percentage of ED visits with ILI diagnosis codes increased steadily from August through December, with a peak in February; this trend matched data collected through ILINet.

Pneumonia and Influenza (P&I) Mortality

BEPHI monitored influenza-related mortality using death certificate data, dividing mortality into three categories: pneumonia or influenza recorded as a contributing factor of death, influenza recorded as the direct cause of death, or pneumonia recorded as the direct cause of death. A total of 1,557 P&I deaths occurred during the surveillance period, with a peak of 256 deaths in February.

Influenza-Associated Pediatric Mortality

Influenza-associated pediatric deaths have been reportable in Kansas since 2006. During the surveillance period, three confirmed influenza-associated pediatric deaths were reported in Kansas. Two had received the 2016-2017 influenza vaccine.

INFLUENZA OUTBREAKS

Forty-four outbreaks were identified and investigated during the surveillance period. The average number of cases was 17 for each outbreak. The majority (66%) occurred in long-term care facilities and six deaths were associated with these outbreaks.

SUMMARY

Typically, ILI in Kansas peaks in December, January, or February. For the 2016-2017 surveillance period, it peaked at 10.4% during the week ending February 11, 2017. This peak rate was higher than what was observed during the previous two surveillance periods; ILI peaked at 3.3% during 2015-2016, and 8.8% during 2014-2015. Four influenza viruses were detected in Kansas this surveillance period: A/H1, A/H3, and two B lineages. The predominant strain in Kansas and the U.S. was A/H3. Antigenic characterization performed by CDC indicated the 2016-2017 seasonal influenza vaccine was a good match for all circulating viruses.

During the 2016-2017 influenza season, 99 deaths were directly attributed to influenza. This was a sharp increase from the previous season of 19 deaths. Of the Kansas deaths, 54% were among those 85 years or older. A total of 44 influenza outbreaks were investigated during this influenza season.

For more information on Kansas influenza surveillance during the 2016-2017 season, see the 2016-2017 Kansas Influenza Surveillance Report.

SECTION III: APPENDICES

APPENDIX A: REPORTABLE DISEASES WITH NO REPORTED CASES, KANSAS, 2016

Disease	Year of last reported case
Anthrax	1972
Botulism	2015
Cholera	2011
Diphtheria	1964
Hansen's Disease (Leprosy)	1999
Hantavirus Pulmonary Syndrome	2012
Measles	2014
Influenza deaths in children <18 years of age	2014
Plague	*Unknown*
Poliomyelitis	1967
Psittacosis	1992
Rabies, Human	1968
Rubella	2006
Severe Acute Respiratory Syndrome	*No cases reported*
Smallpox	1949
Tetanus	2015
Toxic Shock Syndrome	2014
Trichinellosis	1999
Viral Hemorrhagic Fever	*Unknown*
Yellow Fever	*Unknown*

APPENDIX B: REPORTABLE DISEASES IN KANSAS FOR HEALTH CARE PROVIDERS, HOSPITALS, AND LABORATORIES

(K.S.A. 65-118, 65-(K.S.A. 65-118, 65-128, 65-6001 - 65-6007, K.A.R. 28-1-2, 28-1-4, and 28-1-18. Changes effective as of 9/29/2014)

☎ - Indicates that a telephone report is required by law within four hours of *suspect* or *confirmed* cases to KDHE toll-free at 877-427-7317

ⓘ - Indicates that an isolates must be sent to: Division of Health and Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620
For Isolate Questions call: (785) 296-1633

Acquired Immune Deficiency Syndrome (AIDS)
Amebiasis
Anthrax ☎
Arboviral disease (including West Nile virus, Western Equine encephalitis (WEE) and St. Louis encephalitis (SLE)) - indicate virus whenever possible
Botulism ☎
Brucellosis
Campylobacter infections
Chancroid
Chlamydia trachomatis genital infection
Cholera ☎
Cryptosporidiosis
Cyclospora infection
Diphtheria
Ehrlichiosis
Escherichia coli O157:H7 (and other shiga-toxin producing E. coli, also known as STEC) ⓘ
Giardiasis
Gonorrhea
Haemophilus influenza, invasive disease
Hantavirus Pulmonary Syndrome
Hemolytic uremic syndrome, postdiarrheal
Hepatitis, viral (acute and chronic)
Hepatitis B during pregnancy
Human Immunodeficiency Virus (HIV) (includes Viral Load Tests)
Influenza deaths in children <18 years of age
Legionellosis
Leprosy (Hansen disease)
Listeriosis
Lyme disease
Malaria
Measles (rubeola) ☎
Meningitis, bacterial ☎
Meningococcemia ⓘ☎
Mumps ☎
Pertussis (whooping cough) ☎
Plague *(Yersinia pestis)*☎
Poliomyelitis ☎
Psittacosis
Q Fever *(Coxiella burnetii)* ☎
Rabies, human and animal ☎
Rocky Mountain Spotted Fever
Rubella, including congenital rubella syndrome ☎
Salmonellosis, including typhoid fever ⓘ
Severe Acute Respiratory Syndrome (SARS) ⓘ☎
Shigellosis ⓘ
Smallpox ☎
Streptococcal invasive, drug-resistant disease from Group A *Streptococcus* or *Streptococcus pneumoniae* ⓘ
Syphilis, including congenital syphilis
Tetanus
Toxic shock syndrome, streptococcal and staphylococcal
Transmissible Spongioform Encephalopathy (TSE) or prion disease (includes CJD)
Trichinosis
Tuberculosis, active disease ⓘ☎
Tuberculosis, latent infection
Tularemia
Varicella (chickenpox)
Viral hemorrhagic fever ☎
Yellow fever

In addition, laboratories must report:

- Viral load results of reportable diseases
- ALL blood lead levels, as of 12/2002 (KCLPPP/ABLES)
- CD4+ T-lymphocyte count < 500/ µl or CD4+ T-lymphocytes <29% of total lymphocytes

Outbreaks, unusual occurrence of any disease, exotic or newly recognized diseases, and suspect acts of terrorism should be reported within 4 hours by telephone to the Epidemiology Hotline: 877-427-7317